ABSTRACT

Title of Dissertation: Executive functions, effortful control, and social skills as predictors of externalizing behaviors in kindergarten children: A within-informant approach

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The relations of executive functions (EF), effortful control (EC), social skills, and externalizing behaviors were examined based on performance measures and rating scales collected from parents and teachers of kindergarten students. Externalizing problems encompass the most prevalent mental health disorders for children at the kindergarten age. Prior research has found that children who exhibit difficulties with self-regulation (EF, EC) or who lack social skills are more likely to develop externalizing problems in early childhood and beyond. However, these constructs have largely been studied separately, and no studies to date have measured EF, EC, and social skills in relation to children's externalizing behaviors across different methods of measurement and across parent and teacher informants. The current study contributed to the literature on externalizing behaviors in young children by testing the unique contributions of EF, EC, and social skills to externalizing behaviors for parents and teachers separately.

Results indicated that there was low agreement between parents and teachers, but that agreement was higher for children rated in the top 15% of externalizing problems. There were both similarities and differences in the relations of constructs for home and school settings. Greater informant-reported global EF deficits, low ratings of global social skills, and low effortful control were predictive of more externalizing behaviors across parent and teacher informants. However, differences were observed at the subscale level for the specific EF deficits and social skills that predicted parent-reported versus teacher-reported externalizing problems. Additionally, many performance measures of EF, including the NEPSY-II scales and the TAT, significantly predicted teacher-reported externalizing behaviors, but not parent-reported externalizing behaviors. Overall, relations are moderate to high between constructs when both are assessed with the same informant and method of measurement. Implications of these findings for both practitioners and researchers are discussed.

Keywords: informant discrepancies, executive functions, effortful control, social skills, externalizing behaviors, kindergarten

EXECUTIVE FUNCTIONS, EFFORTFUL CONTROL, AND SOCIAL SKILLS AS PREDICTORS OF EXTERNALIZING BEHAVIORS IN KINDERGARTEN CHILDREN: A WITHIN-INFORMANT APPROACH

by

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Executive functions, effortful control, and social skills as predictors of externalizing behaviors in kindergarten children: A within-informant approach

Imagine yourself as a young child, walking into your first day of kindergarten. You say goodbye to your parents and enter a world that is new and unfamiliar to you. What thoughts go through your head? Are you feeling sad, angry, nervous, or scared? If so, do you express these thoughts and feelings outwardly, or hold them in?

Research has shown that your answers to these questions partly depend on your temperament as a young child, or "constitutionally based individual differences in reactivity and regulation" (Rothbart, Derryberry, & Posner, 1994). Your transition from home to formal schooling was likely easier if you had an easy temperament, exhibiting both high regulation and low reactivity, than if you had a difficult temperament, exhibiting both low regulation and high reactivity.

Now, think about your kindergarten classmates in the scenario above. Did they all wait their turn to answer a question in class, sit still and quietly during story time, share their toys, and act respectfully toward their peers? According to years of temperament research, the answer is "probably not." Research consistently shows that young children inherently differ in their ability to regulate their thoughts, emotions, and behaviors (Rothbart & Jones, 1998).

Research has also consistently demonstrated that these self-regulatory skills are crucial to young children's social development. Self-regulation is a strong predictor of social skills (Liew, 2012), classroom adjustment (Denham et al., 2014), and school readiness (Blair & Raver, 2015). In order to display socially appropriate behaviors,

children need to regulate their cognitions, emotions, and behaviors to produce a coordinated response. This coordination to produce socially appropriate behavior involves: 1) *cognition*- attending to environmental cues in order to correctly appraise the situation, 2) *emotion*- monitoring the display of inappropriate affect in favor of the display of appropriate affect, and 3) *behavior*- inhibiting an "automatic" response to the situation that would be considered socially inappropriate in favor of a socially appropriate response. These three components all depend on one another, meaning that a child has to coordinate all three components to respond appropriately. For example, it is insufficient for a child to know the appropriate response (cognition) if he or she lacks the skills to either inhibit the display of negative affectivity (emotion) or perform the appropriate response (behavior).

The three-dimensional nature of self-regulation is best illustrated using a real-world example of a student, referred to here as Max. Imagine that Max is in kindergarten and it is center time during reading. His group is told to transition to independent reading on the carpet. Max sees his favorite book on the carpet, but his peer, Anthony, takes this book before he is able to reach it. Max thinks, "No! He took the book I wanted!" (*cognition*). He feels anger towards Anthony (*emotion*) and aggressively grabs the book from him (*behavior*). Anthony tells his teacher that Max took his book from his hands, and Max is told to go to time out.

Now let's imagine that Max is in 8th grade. He walks into his class when he sees another student, Chris, at the water fountain. Chris hears Max's footsteps and looks back at him. Max, who does not like Chris, thinks, "Why is he looking at me? He must want to start a fight" (*cognition*). His anger towards Chris builds as he clenches his fist and walks

towards him (*emotion*). Max then lunges at Chris, yelling, "Oh, you want to start a fight, huh?" and shoves Chris against the wall, starting a physical altercation (*behavior*). Max is suspended for the day due to his actions.

Max's behavior in both situations represents the congruence of cognitive, emotional, and behavioral regulation. In the first real-world example, when Anthony takes a book that Max wanted, he is unable to regulate his emotions or behavior appropriately. Max is very reactive in this situation, taking the book from Anthony's hands aggressively. Max may have a knowledge deficit (lack the knowledge of an alternative appropriate behavior), a regulation deficit (lack the ability to inhibit his automatic response), and/or a skill deficit (lack the social skills to perform an alternative appropriate behavior). For instance, Max may not know that instead of grabbing the book, he could ask Anthony if he can read the book when Anthony is finished. He may also lack the ability to inhibit his automatic response and/or the social skills to perform this socially appropriate response.

In the second example, when Max takes a cue out of context (*cognition*), he feels and expresses his anger (*emotion),* and responds with a physical altercation (*behavior)*. This situation escalates so quickly because Max is reactive and unable to regulate his uninhibited response to this appraisal, which is to retaliate. Max displays a hostile attribution bias, or a "bias wherein individuals exhibit a tendency to interpret others' ambiguous behaviors as hostile, rather than benign" (Steinberg & Dodge, 1983). Max interpreted Chris' behavior (looking at him) as hostile ("He wants to fight"), rather than benign ("He must have heard me and turned to see who it was"). Research shows that

these types of cognitive distortions are significantly related to externalizing behavior (Helmond et al., 2015).

As demonstrated in the example of Max, difficulties with self-regulation can be observed at a young age and predict the development of externalizing problems, or "problems manifested in outward displays of behaviors that involve a child negatively acting on the external environment" (Eisenberg et al., 2001). Research has shown that two self-regulatory constructs, temperamental effortful control and executive functions, are significantly linked to the development of externalizing problems. Children who exhibit low effortful control and/or deficits in executive functions are more likely to develop externalizing problems in childhood and continue to exhibit these problems in adolescence and beyond.

The aim of this study is to examine the relations among executive functions, effortful control, and social skills to externalizing behaviors for kindergarten children. This study contributes to current research on self-regulation and externalizing behaviors in young children in four key ways. First, difficulties with executive functions (EF), and social skills deficits have been separately identified as predictors of externalizing behaviors in young children through different studies. However, no studies have tested the unique contributions of these predictors to externalizing behaviors when included in the same study. This study examined the unique contributions of self-regulation (temperament, EF) and social skills to externalizing problems. Second, prior research examining the relation between EF and externalizing problems has used a variety of measures, including performance measures and informant questionnaires. Studies including performance measures typically examine what has been termed "cool EF," or

EF on abstract and de-contextualized cognitive tasks. This study also examined the construct termed "hot EF", or EF on cognitive tasks that elicit emotion. A new measure of "hot EF", the EF scale from the Thematic Apperception Test (TAT), is utilized in this study (Annotti & Teglasi, 2017). The TAT requires a child to tell stories about pictures that portray emotional tensions. It is important to examine the contribution of hot EF because externalizing behaviors often occur in emotionally significant contexts. Third, prior research with this age group has mainly relied on measures from a single informant (parent or teacher). This study expanded the measures used to study constructs by examining reports separately for parent and teacher informants. As extensive research has documented discrepancies between parent and teacher ratings of children (Teglasi et al., 2017), relations were tested within each informant (parent and teacher). Finally, whereas prior research has mainly used samples of school age or older children, this study utilized a sample of kindergarten children. This age is important to study because early onset of externalizing behaviors is predictive of more severe problems later in adolescence and adulthood. Specifically, childhood externalizing behaviors are a strong predictor of later juvenile delinquency, adult crime, and violence (Liu, 2004).

Current evidence based programs for children with externalizing behaviors target different underlying causes for these behaviors. For example, the Second Step universal prevention program focuses on building foundational self-regulation skills (Low et al., 2015), whereas the Promoting Alternative Thinking Strategies (PATHS) curriculum targets emotion awareness and emotion regulation (Eisenberg et al., 2010), and the Coping Power program focuses heavily on building social problem solving skills (Lochman & Wells, 2003). The current study examined examine the differential

contributions of executive functions, effortful control, and social skills to externalizing behaviors in children. This knowledge assists in determining the areas that are important to target in interventions for children at-risk for externalizing problems.

Chapter 1: Review of the Literature

A literature review was conducted using the following databases: EBSCO, PsycINFO, and ERIC. English language articles published in peer-reviewed journals and published books were reviewed. Search terms "self-regulation," "kindergarten," "executive functions," "temperament," "social skills," and "externalizing problems" were used. This review will discuss: a) definitions and measures of study constructs, b) how self-regulation typically develops in young children, c) predictors of externalizing problems in young children, and d) how difficulties with self-regulation place young children at risk for externalizing problems.

Self-Regulation

One of the greatest challenges in conducting research in the area of self-regulation is appropriately defining the construct. Karoly (1993) defines self-regulation very broadly, as "the internal and transactional processes that individuals use to guide their goal-directed behavior over time and in various contexts." This broad definition implies that self-regulation encompasses regulation of multiple internal processes (emotion, attention, information processing) that interact with external goals and requirements, both in the moment and over time. Ursache, Blair, and Raver (2008) define self-regulation more narrowly, as "the primarily volitional management of arousal or activity in attention, emotion, and stress response systems in ways that facilitate the use of executive function abilities in the service of goal-directed actions." This definition focuses on self-regulation of executive functions specifically and does not state that the construct operates across time or contexts. These definitions are similar, however, in that they both

state that self-regulation facilitates *goal-directed* behavior. Please refer to Appendix A for examples of different definitions of self-regulation from the literature.

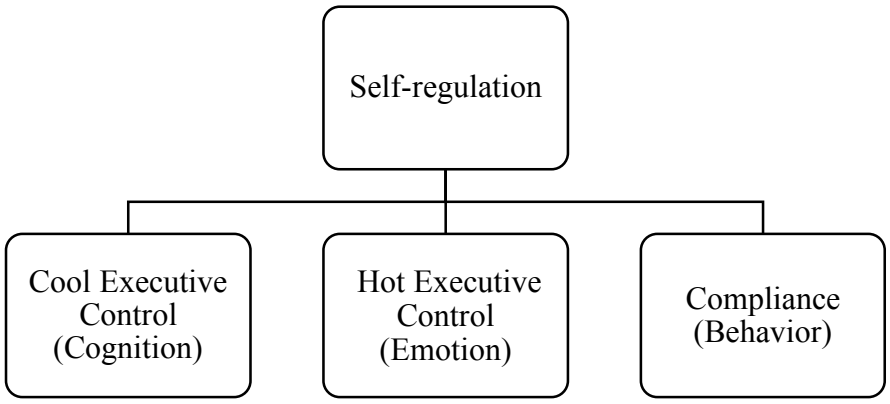
The overarching construct of self-regulation has also been studied from different fields, each with their own perspective on how this construct should be defined (see Appendix B). In the field of neuroscience, self-regulation is typically operationalized as *executive functions (EF)*, or "higher level cognitive processes which help individuals engage in organized, goal-oriented behavior" (Bridgett et al., 2013). In the field of temperament, self-regulation is a key overarching construct that underlies multiple temperamental dimensions. In research, however, temperamental self-regulation is often operationalized as *effortful control*, or "the ability to inhibit a dominant, pre-potent response to perform a subdominant, less salient response and to detect errors" (Rothbart & Bates, 2006). Finally, in the field of human development, self-regulation is often operationalized in terms of children's observable behaviors. *Behavioral regulation* is defined as "the manifestation of executive function skills in observable responses in the form of children's gross motor actions" (Ponitz et al., 2009).

Despite the differences in these perspectives, researchers generally agree that self-regulation involves controlling and monitoring the experience and the expression of one's thoughts, emotions, and behaviors. Research also supports this three-dimensional nature of self-regulation. Denham, Warren-Khot, Bassett, Wyatt, and Perna (2012) found support for a three-factor model of self-regulation that includes the constructs of cool executive control, hot executive control, and compliance (see Figure 1).

Figure 1

Denham and colleagues (2012) model of self-regulation

Figure 1 (Continued)



Cool executive control (CEC), representing the cognition dimension of self-regulation, is defined as "organized, flexible, goal directed cognitive processes that are affectively neutral, slow acting, and later developing." Hot executive control (HEC), representing the emotion dimension of self-regulation, is defined as "emotional and appetitive/motivational processes that are reflexive, fast acting, and early developing." Finally, compliance, representing the behavioral dimension of self-regulation, is defined as "the ability to use internalizing rules and standards to help regulate behavior adaptively and flexibly" (Denham and colleagues, 2012).

Denham and colleagues (2012) tested this model with a diverse sample of preschool children in Head Start and private childcare centers. All three constructs were measured with performance tasks of the Preschool Self-Regulation Assessment (PRSA). Measures of CEC included three cognitive tasks of executive functions: Pencil Tap, Balance Beam, and Tower. Measures of HEC included three executive function tasks that included a motivational or appetitive component: Toy Wrap, Toy Wait, and Snack Delay.

Measures of compliance included three tasks of behavioral obedience: Toy Return, Tower Cleanup, and Toy Sort.

Results confirmed a three-factor model for self-regulation, including the factors of CEC (cognition), HEC (emotion), and compliance (behavior). However, a two-factor model combining CEC and HEC fit equally well to the data, and high co-variances were found between the constructs. This finding provides support that the cognitive, emotional, and behavioral aspects of self-regulation are inextricably linked. Indeed, Denham and colleagues conclude that although these three dimensions of self-regulation can be separated, they likely operate in a unitary fashion in young children.

Another huge challenge in self-regulation research is appropriately measuring the construct to match its definition. Although the definitions of self-regulation discussed above tend to be fairly broad, many measures of self-regulation tend to focus on specific, discrete self-regulatory abilities. The review that follows will define two overlapping areas of self-regulation that are commonly measured in research, *executive functions* and *effortful control,* and discuss the strengths and limitations of various measures for each.

Executive Functions

Executive functions (EF) have been defined as "a collection of processes that are responsible for guiding, directing, and managing cognitive, behavioral, and emotional functions" (Gioa et al., 1996), "multiple, inter-related high level skills responsible for formulating goals, planning how to achieve them, and carrying out these goals effectively" (Anderson & Reidy, 2012), and "an umbrella term for a number of sub-functions including working memory, inhibitory control, and task-switching" (Zelazo et al., 2010). According to McCloskey and Perkins (2012), there is agreement in the extant

literature that EF is "a set of neural mechanisms that are responsible for cueing, directing, and coordinating multiple aspects of perception, emotion, cognition, and action."

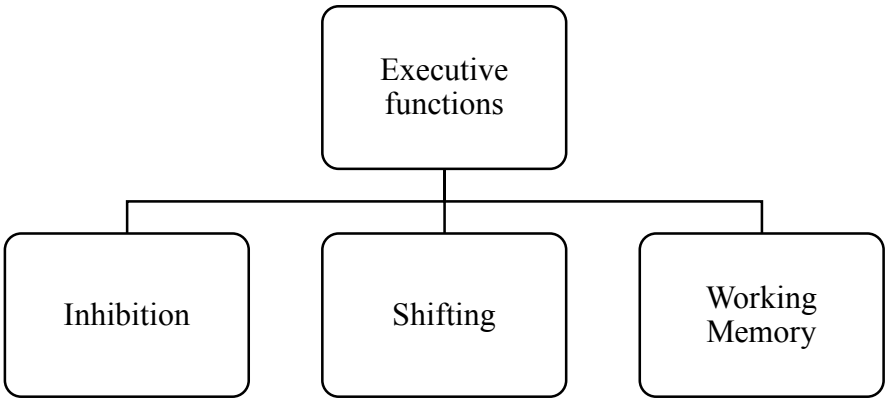
EF: A Unitary Construct or Multiple Processes?

McCloskey and Perkins (2012), characterize EFs as (a) multiple in nature, rather than a unitary construct, (b) directive in nature, in that they cue other mental constructs, (c) operate differentially within four domains: perception, emotion, cognition, and action, (d) vary in use across interpersonal, intrapersonal, and environmental situations, (e) begin to develop in early childhood and most likely continue to develop throughout the life span, and (f) are reflected in activation of neural networks in the frontal lobes. They argue that EFs are *multiple* in nature, meaning that EF is composed of distinct, but interrelated processes.

The three components of EF that have received the most research support are inhibition, shifting, and working memory (Levin & Hanten, 2005; see Figure 2). *Inhibition* involves withholding or suppressing an automatic response. For example, kindergarten children need to inhibit the automatic response to blurt out an answer in class, and instead raise their hand to answer a question from the teacher. *Shifting* is defined as the capacity to transition easily from one condition or task to another. For instance, young children need to transition from various classes and activities throughout the school day, and adjust their behavior accordingly. For example, a child needs to shift from following rules and expectations for behavior during recess to rules and expectations for behavior during class time. Finally, *working memory* is the capacity to hold information and manipulate it in the short-term. For example, children need to remember the multiple steps of a math problem in order to answer the problem correctly.

Figure 2

Model of executive functions as distinct, interrelated processes



Other researchers, however, argue that EF is a *unitary* construct, or central "executor" that directs other attentional resources. According to this perspective, the central executive is a unitary system responsible for selecting and coordinating mental resources, mainly the phonological loop and the visuo-spatial sketch pad (Baddeley, 1992). The phonological loop is responsible for spoken and written material, such as remembering a phone number, whereas the visuo-spatial sketchpad stores and processes visual information, such as navigating a morning commute. According to this model, the central executor decides which information to attend to and where to send that information in the brain.

As both the multiple model of EF and the unitary model of EF have received support in the literature, the issue continues to be debated. However, many EF measures, such as the NEPSY-II, follow the multiple model of EF in that they capture separate and unique EF domains (inhibition, working memory, and shifting).

Hot Versus Cool EF

A recent development in research on executive functions is the distinction between "hot EF" and "cool EF". According to Zelazo, Qu, and Kesek (2010), traditional research on EF has focused on cool EF, or cognitive aspects elicited by abstract, de-contextualized tasks. There has been growing interest, however, in hot EF, or EF seen in situations that are emotionally and motivationally significant. Zelazo and colleagues argue that is important to consider hot EF because cognition and emotion are inextricably linked, and cannot be viewed in isolation. Indeed, emotional aspects have the potential to either interfere with EF or facilitate EF. For example, in the case of Max (*See* Introduction), Max grabbed a book from Anthony that he wanted for himself. He was angry that Anthony took the book he wanted, and this likely interfered with his ability to regulate his behavior.

Similarly, Zelazo and colleagues have demonstrated that emotional aspects can interfere with EF in the marshmallow task. In this task, the examiner presents a child with one marshmallow and tells the child that if they wait until the examiner comes back to eat the marshmallow then they will get to have two marshmallows. Research shows that children's ability to self-regulate behavior on this task depends on what they are told to focus on. Children can wait longer before eating the marshmallow when they are told to focus on the abstract qualities of the marshmallow reward (e.g. imagining how marshmallow are similar to clouds) than when told to focus on the arousing qualities of the marshmallow reward (e.g. imagining how the marshmallow will taste). This supports the hypothesis that the cognitive and emotional aspects of EF are interdependent.

Emotional aspects of a situation also have the potential to facilitate EF. Studies have found that positive mood facilitates performance in ways that may reflect improved EF. For example, Qu and Zelazo (2007) developed an emotional faces version for a Dimensional Change Card Sort (DCCS), a measure of cool EF. In the standard version, children are asked to sort cards by one dimension (e.g. color) and then switch to another dimension (e.g. shape). In the version created by Qu and Zelazo, children are required to sort happy and sad male and female faces by emotion and by gender. Children performed significantly better on the emotional faces version than the standard version, suggesting that emotional aspects of stimuli facilitated EF in a relatively general fashion.

Researchers are thus not measuring the entire construct of EF when they use traditional cognitive EF tasks, as these tests only measure cool EF and ignore the fact that real world cognitive processing occurs in the context of emotional reactions. For example, think back to the introductory example of Max when his peer took his favorite book. In this case, his automatic thought ("He took my favorite book!") is directly linked to his automatic feeling towards the peer (anger). Cognitions and emotions are inextricably linked in real world situations.

Measures of EF

EF can be measured in many ways, including interviews with parents and teachers, observations of the student, tests of cognition, and behavior rating scales completed by the child, parent, and teacher. The table in Appendix C presents commonly used measures of EF and a short description of each measure, for each of these domains.

It is important to distinguish between the typical measures of EF, or those that are less structured and representative of real-world performance, and maximal measures of

EF, or measures that are characterized by high levels of structure and support (Annotti & Teglasi, 2017). For example, two measures that are widely used to assess EF in young children are the NEPSY-II subtests and the BRIEF. The NEPSY-II is an example of a performance measure. Children are asked to perform tasks requiring them to sustain attention, inhibit their responses, plan a response, and self-regulate. (Korkman, Kirk, & Kemp, 2007) The BRIEF, however, is an example of a rating scale. Parents or teachers answer questions relating to their child's ability in eight EF domains. Whereas the NEPSY-II measures cognitive EF, the BRIEF measures EF across various domains. The BRIEF asks questions about the child's EF in emotion (ex: "Mood changes frequently"), cognition (ex: "Thinks too much about the same topic"), and action (ex: "Blurts things out"). Additionally, the NEPSY-II measures the child's EF performance in one highly structured setting, whereas the BRIEF measures the child's EF across various environmental settings (interactions with parents, teachers, and peers).

In their review of twenty studies on EF, Toplak, West, and Stanovich (2013) found only a minimal association between performance-based measures and rating measures of EF for clinical and non-clinical samples. They argue that performance-based measures and rating measures assess different constructs and should not be used interchangeably. For example, the child's performance on a NEPSY-II subtest may not match his or her scores on the BRIEF. The child's ability to self-regulate in an explicit task may not be indicative of his or her ability to self-regulate in their everyday lives, and vice-versa. This review illustrates how the ways we define and measure EF has real consequences for assessment, diagnosis, and intervention.

Before we can use EF to predict important developmental outcomes, we need to match the definition of EF to the measures we use. For example, in the current study, "hot EF" was measured with the TAT, a task that is less structured, elicits emotion, and is more predictive of everyday EF abilities, while "cool EF" was measured with the NEPSY-II subtests, or performance tasks of the child's executive function abilities under highly structured settings.

Effortful Control

Effortful control is a construct that originates from research on temperament, defined as "constitutionally based individual differences in reactivity and regulation" (Rothbart et al., 1994). Three physicians, Thomas, Chess, and Birch, are responsible for developing the construct of temperament in the 1970's. As these physicians continued to observe that two children could be raised in the same environment but interact with their world in very different ways, they came to reject the one-sided hypothesis that a child's environment is fully responsible for his or her behaviors (Thomas et al., 1970). They defined temperament as the individual differences in children that are biologically based, modulated by the environment, and can be identified as early as two to three months.

Based on data collected from the New York Longitudinal Study, the researchers identified nine characteristics of temperament: Activity Level, Rhythmicity, Distractibility, Approach/Withdrawal, Attention Span and Persistence, Intensity of Reaction, Threshold of Responsiveness, and Quality of Mood. They also identified three temperament types: *easy,* infants that adjust well to new situations and routines and are generally cheerful and calm (40% of infants), *difficult,* infants that adjust poorly to new situations and have strong negative reactions to environmental stimuli (10 % of infants)

and *slow to warm up,* infants that are difficult at first but become easier over time (15 % of infants).

The most commonly used measure of temperament in children is the Children's Behavior Questionnaire (CBQ; Rothbart & Posner, 1996). The CBQ is based on years of research that has consistently identified three overarching temperamental factors: Surgency/Extraversion, Negative Affectivity, and Effortful Control (Rothbart, Ahadi, Hershey, & Fisher, 2001). The Surgency/Extraversion factor includes the dimensions of Impulsivity, Shyness, Activity Level, and High Intensity Pleasure. The Negative/Affectivity factor includes the dimensions of Anger, Discomfort, Sadness, Discomfort, Soothability, and Fear. Effortful control (EC) is responsible for modulating emotional reactivity and behavior. EC is composed of the Attentional Focusing, Inhibitory Control, Perceptual Sensitivity, and Low Intensity Pleasure scales. The Attentional Focusing and Inhibitory Control Scales are particularly relevant to self-regulation for young children. Attentional focusing is the "tendency to maintain attentional focus upon task-related channels" and inhibitory control is the "capacity to plan and to suppress inappropriate approach responses under instructions or in novel or uncertain situations" (Rothbart & Bates, 2006).

It is important to note that effortful control (EC) and executive functions (EF) are similar, overlapping constructs (Bridgett et al., 2013). Specifically, EC is similar in its definition to the EF of inhibition. EC and EF are also similar in that they share the same neurobiological correlates. The anterior cingulate gyrus and areas of the prefrontal cortex have both been implicated in both EF and EC. EF and EC also share a similar developmental course, with both appearing early in childhood and improving with

development. Finally, EF and EC and are associated with similar outcomes; both are implicated in effectively regulating negative emotions and negatively related to externalizing problems.

Effortful control (EC) and executive functions (EF) are also distinct constructs in a few ways. First, EC is a unitary construct, while some researchers argue that EF may consist of multiple processes (shifting, inhibition, and working memory). In addition, effortful control is mostly measured with rating scales from parents and teachers, whereas executive functions can be measured with either performance tasks or informant report. Finally, EC is considered relatively stable throughout the lifespan whereas EF capacities increase with development.

Social Skills

Social skills refer to "abilities that promote adaptive behavior and facilitate adjustment and effective coping with daily life demands "(WHO, 2013). Children with strong social skills are able to engage in appropriate play with their peers, develop and maintain friendships, and effectively resolve conflicts with others (Cillessen & Bellmore, 2011). Social skills can be measured indirectly through parent and teacher ratings, peer nominations, and responses to hypothetical situations, or directly through observations in the lab or in a natural setting of the child's interactions with others.

One commonly used rating scale of social skills that was utilized in the current study is the Social Skills scale of the Social Skills Improvement System (SSIS; Gresham & Elliott, 2008). In this scale, parents and teachers are asked to rate the frequency in which a child engages in behaviors using a 4-point Likert scale ("Never," "Sometimes," Often," "Always"). This scale measures seven discrete social skills: Communication,

Cooperation, Assertion, Responsibility, Empathy, Engagement, and Self-Control, and calculates a total overall Social Skills score.

Theoretically, executive functions and effortful control are related to social skills in that they are necessary to navigate the social environment. In the case of Max (*See* Introduction), he would have needed to first inhibit his automatic response to take the toy in order to then perform a socially appropriate response. In support of this, early research has indicated a positive relation between self-regulation skills and positive social behaviors. Specifically, Eisenberg and Miller (2008) propose that a child who is demonstrating higher levels of self-regulation is more able to experience empathy when another individual is in distress and thus perform a pro-social behavior.

In addition, Annotti and Teglasi (2017) found that the relation between EF and social skills is dependent on the measure being used to study EF. They found that the relation between executive functions and social skills, as measured by the SSIS, was strong (excellent model data-fit) when executive functions were measured by a storytelling task (Thematic Apperception Test; TAT), but weak (poor model data-fit) when executive functions were measured with discrete performance tasks (NEPSY II). Annotti and Teglasi (2017) conclude that the TAT is a better predictor of social skills, because the TAT is more representative of EFs that resemble those used in the real-world.

Externalizing Problems

Externalizing problems have been defined as “non-compliance, poor self-control, and problematic social relationships” (Campbell, 1995). Importantly for the current study, it is estimated that 10-15% of Kindergarten children display mild to moderate

externalizing behaviors, making externalizing problems the most prevalent mental health disorder in kindergarten children (Campbell, 1995). In addition, childhood externalizing problems are a strong predictor of later juvenile delinquency, adult crime, and violence (Liu, 2004).

The two most commonly used classification systems of mental health disorders are the Diagnostic and Statistical Manual of Mental Disorders: Fifth Edition (DSM-5; American Psychiatric Association, 2013) and the International Statistical Classification of Diseases and Related Health Problems: Tenth Edition (ICD-10). Research based on both of these classification systems has supported a distinction between *internalizing disorders*, or those that are more internal to the individual (e.g. anxiety, depression, and somatization), and *externalizing disorders*, or those that are more overtly expressed in the individual's environment (e.g. aggression, impulsivity, and conduct problems). In support of this, comorbidity (the simultaneous presence of 2 or more disorders) often occurs within either the internalizing or externalizing domain. For instance, there is a high comorbidity between the two internalizing disorders of depression and anxiety, with a recent study finding that 67% of individuals diagnosed with a depressive disorder also had a current anxiety disorder (Lamers, van Oppen, Comijs,Spit, Spinhoven, & van Balkom, 2011). Comorbidity also occurs between some externalizing and internalizing disorders, and this may be due to shared root causes. For example, the comorbidity between Depression and Conduct Disorder may be explained by a shared low sensitivity to reward. Depression is distinct from Conduct Disorder, however, in that Depression is characterized by high levels of inhibition whereas Conduct Disorder is characterized by low levels of inhibition (Wolff & Ollendick, 2006).

In the DSM-5, *externalizing disorders* mainly fall under the category of Disruptive, Impulse-Control, and Conduct Disorders. The three main disorders relevant to young children in this category are Oppositional Defiant Disorder (ODD), Conduct Disorder (CD; Childhood Onset Type), and Intermittent Explosive Disorder (IED). According to the DSM-5 manual, these disorders are grouped together because they share an underlying difficulty with both emotional regulation (anger and irritation) and behavioral regulation (argumentativeness and defiance). The disorders in this group differ, however, in their relative emphasis on these two types of self-control. IED is largely related to difficulties with emotional regulation, while CD is mainly due to difficulties with behavioral regulation, and ODD is a combination of difficulties with both types of regulation. Overall, these disorders are more common in males than females, and tend to emerge in childhood.

The DSM-5 defines each of these disorders as a frequent and persistent pattern of behavioral symptoms that occur across settings, cause distress to the individual, and have a negative impact on social, educational, and other areas of functioning. The most common of these three disorders is ODD, occurring in approximately 3.3% of the population. ODD is specifically defined as a "frequent and persistent pattern of angry/irritable mood, argumentative/defiant behavior, or vindictiveness lasting at least 6 months" (APA, 2013). Symptoms typically emerge in the preschool years, and there is evidence of a developmental progression from ODD to CD. However, most children who meet the criteria for ODD will not go on to develop CD (APA, 2013).

An important construct related to externalizing disorders is aggression. Aggression can be deemed *reactive,* or aggression that occurs in response to a

provocation to the individual. An example of reactive aggression is a child hitting a parent when the parent takes a toy away from them. On the other hand, *proactive aggression* occurs when one acts aggressively in order to obtain a physical or social reward. A related example of proactive aggression is a child taking a toy from another peer so he can play with it himself. Although theories over the past two decades have supported the reactive-proactive distinction, the distinction can be hard to make when operationalizing these constructs with rating scales and observational measures (Kemps et al., 2005) In real life, it can also be difficult to pinpoint the cause of aggressive behavior. For instance, in the case of Max (see Introduction), Max's aggressive behavior of taking the book appeared to be a reaction to the peer taking the book. Yet, his behavior could also be described as proactive in that he took the book because he wanted it for himself.

In addition, data collected from teacher rating scales demonstrated that most aggressive children demonstrated both reactive and proactive aggression, while few fit the reactive only or proactive only category (Dodge & Coie, 1987). Although the proactive-reactive distinction is still debated, it is important to consider in this study because of its link to self-regulation. Theoretically, reactive aggression is more likely to be related with difficulty regulating emotions and behavior, while proactive aggression is not necessarily related to these regulation deficits.

How Self-Regulation Develops in Young Children

The development of self-regulation is a normative process that begins in early childhood. At a very young age, children look to adults, such as parents and teachers, to act as their external regulators. For instance, imagine an infant that begins to cry because

he or she is hungry. The caregiver helps soothe the infant by nursing the infant, and thus meeting his or her basic need for food. The caregiver may also soothe the infant by making feeding a positive experience, in ways such as smiling at the infant and speaking in a soothing voice to the infant. Through these repeated experiences managing appropriately challenging situations (e.g. waiting a short time to be fed), children develop in their ability to self-regulate (Florez, 2011). In support of this, research shows that having caring, consistent relationships with adults is associated with stronger self-regulation abilities (Bornstein, 2012).

Vygotsky (1934) described a process termed *internalization*, in which children begin to shift from external regulation provided by caregivers to independent regulation. This process begins as early as infancy and continues to develop through childhood. For instance, as young as infancy, babies can suck their thumb to soothe themselves in response to hearing a loud noise. In toddlerhood, children begin to learn how to inhibit their automatic responses and comply with directions from caregivers. For example, a toddler may learn that they need to wait to hold their mother's hand before crossing the street. When children enter school, they continue to develop in their self-regulatory abilities. Children learn the behavioral expectations of the classroom, and are better able to differentiate between socially acceptable and socially unacceptable behavior. Kindergarten is a crucial time for the development of these skills, as this is many children's first time in a structured full-day academic setting. This is especially true in modern kindergarten classrooms, where the academic expectations for children continue to be raised.

According to Vygotsky, adults such as parents and kindergarten teachers can best support the development of children's self-regulation by holding developmentally appropriate expectations for the child. Adults should provide opportunities for children to develop self-regulatory abilities that are within this zone of proximal development (ZPD). For instance, a kindergarten teacher may ask children to sit still for a 5-minute story, but it would not be appropriate to expect them to sit still for an hour without a break.

Teachers can also support the development of self-regulation by modeling, or demonstrating to the child how to use self-regulation, teaching self-regulation and using visual cues such as "Stop and Think," cuing the child in the moment when to use self-regulation, and gradually withdrawing adult support when the child demonstrates success (Florez, 2011). For instance, in the example of Max (See Introduction), the kindergarten teacher may have intervened to help Max learn to use self-regulation skills. The teacher could have cued Max to "stop and think" before taking the book, ask Max what he could do instead of grabbing the book (ask Anthony if he could read it when he is done), model this skill for Max, and then allow Max to demonstrate the skill on his own.

Importantly, the process in which self-regulation develops is dependent on the child's temperament. Temperament traits such as mood, irritability, and adaptability to change can affect a child's capacity for emotional regulation (Thompson, 2001). When there is goodness of fit, or an environment that matches the child's temperamental dispositions, children are better able to regulate their behavior (Gillespie & Seibel, 2006). For example, goodness of fit would not occur naturally in the case of a highly active child with a shy and reserved parent. This case would require the parent to understanding the child's temperament and appropriately respond and/or modify the environment to match

the child's temperamental dispositions. Goodness of fit is also important to consider in the instructional environment. For example, a highly active child may need to take movement breaks, and stand while completing work at school.

Risk Factors for Externalizing Problems in Young Children

Self-Regulation and Externalizing Problems

Unsurprisingly, self-regulation is associated with many short and long term positive outcomes for children (see Appendix D). The ability to regulate one's emotions, thoughts, and behaviors is positively associated with academic skills, math and reading achievement, classroom adjustment, adaptive behavior in school, social skills, and school readiness. Conversely, difficulties with self-regulation are associated with increased experiences of socially challenging situations, internalizing problems, and externalizing behaviors for youth.

Given that self-regulation is associated with many developmental outcomes, there may be multiple pathways through which self-regulatory deficits place children at risk for externalizing problems. For instance, problems with self-regulation may cause a child to not attend in class, then get behind their peers academically, and demonstrate externalizing behaviors at school when work is considered too challenging. There are a host of possible developmental trajectories to explain the link between self-regulation deficits and externalizing behaviors.

One explanation for externalizing behaviors can be termed the *regulation hypothesis,* or the theory that children display externalizing behaviors because they lack the ability to regulate their behavior. In the case of Max (*See* Introduction), perhaps Max wanted the book from Anthony and pulled it out of his hands because he lacked the

ability to control his behavior. In support of this, research has found that deficits with executive functions and low temperamental effortful control are associated with externalizing behaviors in young children.

Schoemaker, Mulder, Dekovic, and Matthys (2013) conducted a meta-analysis of studies that investigated the relation between executive functions and externalizing problems in young children. They included 22 studies and a total of 4021 children from both clinical and community samples in their meta-analysis. The researchers separated studies by the type of EF that was measured: inhibition, working memory, and cognitive flexibility (set-shifting). All studies included in this meta-analysis utilized performance based measures of "cool EF". An example measure of an inhibition EF task is NEPSY-II Statue, where children are told to remain still as a statue with eyes closed for 2 minutes despite the examiner's distractions, such as tapping on the table or humming aloud. An example measure of a working memory EF task is Digit Span, where children listen to the examiner read a series of numbers and are told to repeat the numbers back in order. An example measure of a cognitive flexibility (set-shifting) task is the Day-Night Task, where children have to initially verbally respond with "day" to daytime pictures (e.g. sun) and "night" to nighttime pictures (e.g. moon), and then are told to switch responses to "day" to nighttime pictures and "night" to daytime pictures.

Studies included in this meta-analysis also included a measure of externalizing problems. Most studies utilized a combination of questionnaire measures or interviews completed with the child's parent and/or teacher. Specifically, sixteen different instruments were used to assess externalizing behavior problems for studies included in this meta-analysis, including eleven questionnaires and five semi-structured interviews.

Ten of the studies included in the meta-analysis used reports from multiple informants, such as parents in combination with a teacher, health visitor, or research assistant. Eight studies in the meta-analysis included a measure from both parents and teachers of externalizing problems. Importantly, studies did not analyze patterns in findings separately for parents and teachers, but rather used some type of combination of parent and teacher ratings and/or interviews to differentiate the externalizing problem group and control group in the study. The results of these eight studies are summarized in table format in Appendix E.

According to this meta-analysis, the EF of inhibition was a moderate and significant predictor of externalizing problems for preschool children (ES=0.24), and especially for older children ages 4.5-6 (ES=.31). The EFs of set-shifting and working memory, however, were not significant predictors of externalizing problems according to this meta-analysis. Schoemaker and colleagues concluded that the EF of inhibition may be especially related to externalizing problems at this age, consistent with prior research. They also suggested that the EFs of working memory and set-shifting may not be related to externalizing problems at this age, because these EFs are more complex according to the hierarchical model of EF and take longer to emerge.

Researchers have also examined the relations among various temperamental dimensions and externalizing problems in young children. The majority of the research has focused on Negative Affectivity and Effortful Control. Negative Affectivity is considered a marker of emotional dysregulation that predisposes children to externalizing behavior problems (Oldehinkel et al., 2004). Children with high Negative Affectivity become easily frustrated, which can lead to a pattern of anger, irritability, or aggression.

In contrast, children with high Effortful Control are able to modulate their behavior and inhibit the dominant, impulsive response (Olson et al. 2005). Thus, these children have the ability to use attentional control and other coping strategies to monitor and adjust their behavior. As such, effortful control has been positively related to social competence and negatively related to externalizing behavior and anger among preschoolers (Blair et al., 2004).

In their review of temperamental vulnerabilities to conduct problems, Frick and Morris (2004) suggest that temperamental low self-regulation is associated with reactive, emotionally driven conduct problems (e.g., reactive aggression). Low levels of self-regulation are less likely to be related, however, to proactive externalizing behaviors (e.g., instrumental aggression that is used for personal gain or to influence and coerce others). In support of this theory, White, Jarrett, and Ollendick (2012) examined the relation between self-regulation deficits and reactive versus proactive aggression. The researchers included a clinical sample of 84 children (54 males and 31 females) ages 6 to 16 years. They administered three measures to parents: the Child Behavior Checklist (CBCL) as a measure of internalizing and externalizing problems, the BRIEF as a measure of executive functions, and the Reactive Proactive Aggression Measure (RPA) as a measure of reactive and proactive aggression. An example of a reactive aggression item is “when teased, strikes back” whereas an example of a proactive aggression item is “threatens or bullies others.” White and colleagues found that both poorer behavioral self-regulation (BRI) and poorer cognitive self-regulation (MCI) were associated with reactive but not proactive aggression. Their study was consistent with the findings of

Ellis, Weiss, and Lochman (2009), who confirmed the same hypothesis using performance-based measures of EF.

Only one study to date conducted by Latzman (2009) examined the relations among EF, temperament, and externalizing problems, and this study drew from a sample of adolescent males. This study included 174 male youth ages 11-16 and their mothers. Youth were administered a battery of neuropsychological measures of "cool EF", from the Delis-Kaplan Executive Function System (D-KEFS). The D-KEFS is a performance measure of executive functioning that measures Conceptual Flexibility (the ability to engage in flexible thinking and behavior), Inhibition (the ability to inhibit a dominant automatic response), and Monitoring (the ability to monitor and evaluate information in working memory). Mothers and youth completed a measure of temperament (Schedule for Nonadaptive and Adaptive Personality; SNAP). The SNAP measures Negative Temperament, Positive Temperament, and Disinhibition (conceptually similar to effortful control). Mothers and youth also completed a measure of externalizing behaviors (Child Behavior Checklist; CBCL and Youth Self Report; YSR). Results indicated that high Negative Temperament on the SNAP and Disinhibition on the SNAP were both correlated with the Conceptual Flexibility and Inhibition domains on the D-KEFS. In addition, negative temperament on the SNAP and disinhibition on the SNAP were associated with self and mother reports of externalizing behaviors. Only the Conceptual Flexibility Domain of the D-KEFS was associated with mother, but not self-report, of externalizing behaviors.

Social Skills and Externalizing Problems

Another explanation for externalizing problems can be termed the *social skills hypothesis,* or the theory that children display externalizing behaviors because they lack the knowledge or skills to perform an alternative socially appropriate response. In the case of Max (*See* Introduction), perhaps Max wanted the book from Anthony and pulled the book from Anthony's hands because he lacked the knowledge and skills to perform a socially appropriate response. In the case, an appropriate response could have been to ask Anthony if he could have the book when Anthony was done reading.

In support of this hypothesis, research shows that children who are lacking in social skills are more likely to develop externalizing behaviors (Vinnick & Erickson, 1992). Specifically, children who display social skills deficits are more likely to act aggressively toward peers, have difficulty cooperating to achieve a common goal, and struggle with taking other's perspectives (Altmann & Gottlib, 1998).

In community samples, children with externalizing symptoms are more likely to have reduced social competence as measured by the acceptance of their school classmates (Bornstein et al., 2010). In clinical samples, children with externalizing disorders such as ADHD, ODD and disruptive behavior disorder present with more social deficits, specifically in terms of less sharing behavior, less empathy, and less prosocial behavior. In a review of twenty-one studies conducted with preschool age children ranging from ages 3 to 6, early externalizing symptoms were accompanied by lower levels of helping or cooperating with others (Huber et al., 2019).

Other Established Risk Factors of Externalizing Problems

Although the present study focuses on child characteristics, there are other established risk factors for externalizing problems that are important to note. Gender is

one established risk factor for externalizing problems. Males are significantly more likely to display externalizing problems than females in childhood. For instance, Oppositional Defiant Disorder (ODD) is 1.4 times more common in males than females prior to adolescence. Another established biological risk factor for externalizing problems is family history. Children with at least one parent diagnosed with oppositional defiant disorder, conduct disorder, or attention deficit/hyperactivity disorder are more likely to display externalizing problems themselves. In addition, having a sibling with a disruptive behavior disorder is a risk factor for developing a disruptive behavior disorder. There are also environmental risk factors associated with externalizing problems. Established environmental factors include harsh parental discipline, abuse, neglect, poverty, large family size, and exposure to violence (Gathright & Tyler, 2014).

Informant Discrepancies

In the current study, both parents and teachers completed rating scales of children's executive functions, social skills, and behavior. Hypotheses were examined separately for parent report and teacher reports, however, because of documented research on "informant discrepancies," or differences between ratings of various informants (self, parent, teacher, clinician, etc.) on the same measure. Achenbach, McConaughy, and Howell (1987) conducted a meta-analysis to evaluate relations between data obtained from different informants on children's behavioral and emotional problems. In their review of 119 published studies, the authors found that the correlations between ratings of children's behavioral/emotional problems were higher (about .60) when the informant played similar roles with respect to the child (i.e. pairs of teachers). Correlations were much lower (ranging from .24 to .42) for ratings between different

types of informant (i.e. parent/teacher pairs). Achenbach and colleagues concluded that low correlations between different informants are not due to issues in the reliability of the measures. Rather, they suggest that each type of informant contributes a considerable amount of variance not accounted for by others.

In support of this, Meyer and colleagues (2001) also reviewed studies for a wide array of contrasts (self vs. parent, self vs. clinician, self vs. teacher, parent vs. teacher, etc.) for children, adolescents, and adults. The authors similarly found relatively low to moderate associations between independent methods of assessing similar constructs. Specifically, correlations between parent and teacher reports of child's behavioral and emotional problems were low, ranging from .16 to .29. In line with Achenbach and colleagues (1987), they conclude that each assessment method identifies useful data not available from other. Parents and teachers each contribute unique information about a child's profile of strengths and deficits.

According to De Los Reyes (2013), most informant discrepancies occur because of two realities. First, informants systematically vary in where they observe the behavior being assessed. Different informants (parent versus teacher) observe the child in different contexts (home versus school). Second, children systematically vary in where they express the behavior being assessed. Informants may disagree because children may express certain behaviors in some settings and not in others. For instance, a child may act reserved around his or her peers in school, but act very social around his or her family at home. Informant discrepancies are thus expected when the child expresses the assessed behavior differently across contexts. In this way, informant discrepancies may yield different, but not necessarily conflicting, conclusions.

De Los Reyes, Henry, Tolan, and Wakschlag (2009) tested this assumption empirically in their study of informant discrepancy in measures of children's disruptive behavior. In this study, De Los Reyes and colleagues examined patterns of observed preschool disruptive behavior across varying social contexts in the laboratory and whether they related to parent-teacher discrepancies of disruptive behavior in a sample of 327 preschoolers. The researchers observed four patterns of disruptive behavior: (a) low across parent and examiner contexts, (b) high with parent only, (c) high with examiner only, and (d) high with parent and examiner. They found that observed disruptive behavior specific to the parent context was related to parent-identified disruptive behavior. Similarly, observed disruptive behavior specific to the examiner context was uniquely related to teacher-identified disruptive behavior. Further, observed disruptive behavior across both parent and examiner-contexts was associated with disruptive behavior as identified by both informants. These findings support the hypothesis that informant discrepancies indicate true differences in the context in which children's behavior occurs. Rather than discounting one source of information, this study proposes to test hypotheses separately from the parent and teacher informants.

A recent study conducted by Sofia Major, Seabra-Santos, and Martin (2018) examined informant agreement for parent and teacher ratings of behavior problems (BPs) in preschoolers. Specifically, they utilized latent profile analysis (LPA) as a novel approach to examine parent-teacher agreement. Parents and teachers completed the Problem Behavior Scale of the Preschool and Kindergarten Behavior Scales-Second Edition (PKBS-2). Results indicated that, generally, parents rated their children as having more behavior problems than did teachers. In addition, there were higher levels of

agreement between parents and teachers for children on the extreme ends of behavior problems (either low or high).

Eight clusters were obtained in this study. In clusters 1 through 5, there were higher levels of parent-teacher agreement. Cluster 1 included children who were rated with very low BP according to both parents and teachers. These children would be considered to be very well-adjusted. Cluster 2 included children who were rated with no significant BP concerns according to both reports, but somewhat higher parent ratings of BPs. Cluster 3 included children who were rated with no significant BP concerns according to both reports, but somewhat higher teacher ratings of BPs.

Clusters 4 and 5 included children who may be at-risk for behavior problems across settings. Cluster 4 included children who were rated with mild to moderate BPs according to both parent and teacher reports. Cluster 5 included children who were rated with mild to moderate internalizing problems according to both parent and teacher reports.

Clusters 6 and 7 pose the most challenges to interpreting parent and teacher discrepancies. In Clusters 6 and 7, one rater indicated moderate to severe BPs, whereas the other rater indicated no BPs above typical levels. In Cluster 6, teachers rated behaviors as significantly more problematic than parents. In Cluster 7, parents rated behaviors as significantly more problematic than teachers.

Finally, Cluster 8 represented children who may require immediate intervention and support. In Cluster 8, children were rated by both parents and teachers as having significant levels of externalizing BPS.

Overall, Major and colleagues recommend using LPA as an alternative to traditional approaches of compositing parent and teacher ratings. They argue that there may be agreement between parents and teachers for some children with BPs, but not about others. First, differences could be due to the fact that children are observed in different settings and may act differently in each setting (home and school). In addition, teachers have a natural normative sample to compare children in their classroom while parents do not have this normative reference point. They recommend LPA as a possible approach for large-scale screening of students and identifying the types of assessments and interventions that may be useful for each cluster of children.

Introduction of the Current Study

Prior research has established that executive functioning, effortful control, and social skills are each separately related to externalizing problems Kindergarten children. However, these variables have not been studied together in prior research. It is important to study these variables together in order to better understand their joint and unique contributions to externalizing problems.

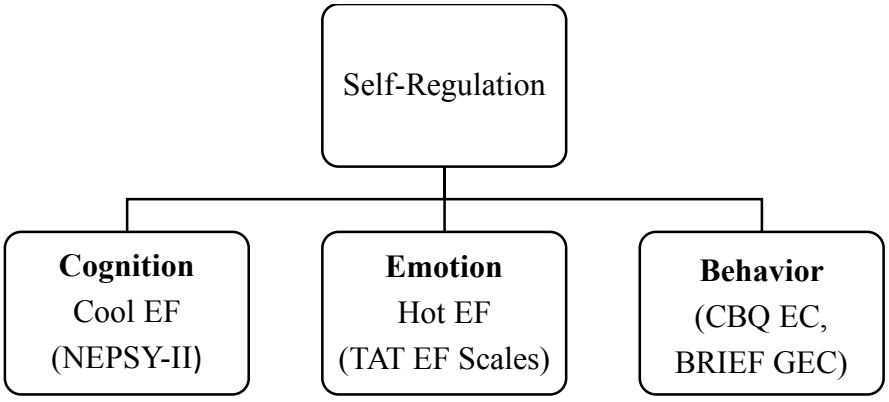
Executive functioning (EF) and effortful control (EC) are related in that they both fall under the broader umbrella of self-regulation (Bridgett et al., 2013). One key difference between EF and EC is how they are measured, with EF typically measured with task performance and EC typically measured by informant (parent or teacher) report. Only one study to date has considered both EF as measured with task performance and EC as measured by informant report in relation to externalizing problems, and this was for an adolescent sample (Latzman, 2009). In this study, results indicated that effortful control (Disinhibition) was associated with youth and mother reports of externalizing

behaviors on the CBCL and YRS, and a domain of executive functioning (Conceptual Flexibility on the D-KEFS) was associated with mother reports of externalizing behaviors (Latzman, 2009). The current study examined this relation for kindergarten children, which is important because childhood externalizing behavior problems is one of the strongest predictors of criminal offending in adolescence and adulthood (Farrington & Hawkins, 1991).

In a three-factor model of self-regulation proposed by Denham and colleagues (2012), self-regulation includes three components: a) cognitive regulation, b) emotional regulation, and c) behavioral regulation. This study adapted this three-factor model (see Figure 3).

Figure 3

Measures used in this study to assess components of self-regulation, as adapted by Denham and colleagues (2012) model of self-regulation



The cognitive component of self-regulation was measured by the child's performance on "cool EF" tasks, or the NEPSY-II Attention and EF subtests. Prior research has documented that difficulties on "cool EF" tasks, especially on inhibition

tasks, is significantly related to externalizing problems, especially in children who are 4.5-6 years old (Shoemaker et al., 2013).

The emotional component of self-regulation was measured by the child's performance on a "hot EF" task, the Thematic Apperception Test (TAT). "Hot EF" is a relatively new construct in the field, that considers EF in situations that are emotionally or motivationally significant (Zelazo et al., 2010). Theoretically, "hot EF" would be significantly linked to externalizing behaviors in children, because behavior problems in everyday life often occur in emotionally significant contexts (Zelazo, Qu, & Kezek, 2010). The TAT has previously been utilized as a measure of EF in young children (Annotti & Teglasi, 2017). The TAT is conceptualized as a measure of "hot EF" because the child is required to recognize the emotional tensions faced by the story characters, and use reasoning to resolve the dilemma in ways that address both the problem and emotional issues (i.e., cognitive and affective components of the problem). Notably, in a previous study, the TAT and NEPSY were moderately correlated (r = .42; Annotti & Teglasi, 2017).

Finally, the behavioral component of self-regulation was measured by informant reports of the child's behavior, including the Behavior Rating Inventory of Executive Functions (BRIEF) and the Child Behavior Questionnaire (CBQ). Importantly, these measures may also capture the emotional component of self-regulation because informants are rating the child's behavior in real-life, emotional contexts. Prior research has documented that, on the BRIEF, both poorer behavioral self-regulation (BRI) and poorer cognitive self-regulation (MCI) were associated with reactive but not proactive aggression (White et al., 2012). Effortful control was measured as a temperamental

domain of the CBQ. By using behavioral ratings of EF (with the BRIEF) and of EC (with the CBQ), this study will consider the unique contributions of EF and EC when both are measured by informant-report.

Social competence is a separate construct from self-regulation. However, associations have been widely demonstrated between social competence and self-regulatory constructs of EF and EC. Self-regulation is also necessary for socially skilled behavior (Denham et al., 2012). A child must first self-regulate in order to demonstrate appropriate social skills, such as taking turns in play (cooperation), helping someone who is upset (empathy), or expressing how they are feeling (communication). In this study, social skills were measured by parent and teacher reports on the Social Skills Scale of the Social Skills Improvement System (SSIS).

In conclusion, in this study I examined how different measures of executive functioning, effortful control, and social skills (e.g. performance versus rating scale; parent versus teacher) relate to externalizing behaviors in young children. Given prior research documenting informant discrepancies between parents and teacher reports at this age (See *Informant Discrepancies*), relations were examined within each informant (parent and teacher).

Study Hypotheses

Hypothesis 1. The relation between performance-based self-regulation and externalizing behavior

Hypothesis 1A Parent. Hypothesis 1A (parent) was that the subtests measuring aspects of "cool EF" (Auditory Attention, Design Fluency, Inhibition, and Statue) would each negatively predict parent-reported externalizing behaviors (SSIS Parent

Externalizing Problems Scale). Previous research demonstrates that NEPSY-II tasks measuring aspects of inhibition (Auditory Attention, Inhibition, and Statue) are most strongly related to externalizing problems in this age group (Schoemaker et al., 2013). Simultaneous multiple regression was used to test this hypothesis.

Hypothesis 1A Teacher. Hypothesis 1A (teacher) was that the subtests measuring aspects of "cool EF" (Auditory Attention, Design Fluency, Inhibition, and Statue) would each negatively predict teacher-reported externalizing behaviors (SSIS Teacher Externalizing Problems Scale), while controlling for the influence of the school the child attended (for more detail, *see* Procedure for Nesting Effects). Hierarchical multiple regression was used to test this hypothesis.

Hypothesis 1B Parent. Hypothesis 1B (parent) was that "hot EF," as measured by the three TAT scales (Abstraction, Perceptual Integration, and Self-Regulation) would negatively predict parent-reported externalizing behaviors (SSIS Parent Externalizing Problems Scale). Simultaneous multiple regression was used to test this hypothesis.

Hypothesis 1B Teacher. Hypothesis 1B (teacher) was that "hot EF," as measured by the three TAT scales (Abstraction, Perceptual Integration, and Self-Regulation) would negatively predict teacher-reported externalizing behaviors (SSIS Teacher Externalizing Problems Scale), while controlling for the influence of the school the child attended (for more detail, *see* Procedure for Nesting Effects). Hierarchical multiple regression was used to test this hypothesis.

Hypothesis 1C Parent. Hypothesis IC (parent) was that "hot EF" and "cool EF" would jointly negatively predict parent-reported externalizing behaviors (SSIS Parent Externalizing Problems Scale), and that the variance in externalizing problems accounted

for by both "hot EF" and "cool EF" would exceed the variance accounted for by "hot EF" or "cool EF" alone. Simultaneous multiple regression was used to test this hypothesis.

Hypothesis 1C Teacher. Hypothesis IC (teacher) was that "hot EF" and "cool EF" would jointly negatively predict teacher-reported externalizing behaviors (SSIS Teacher Externalizing Problems Scale), and that the variance in externalizing problems accounted for by both "hot EF" and "cool EF" would exceed the variance accounted for by "hot EF" or "cool EF" alone. Hierarchical multiple regression was used to test this hypothesis, while controlling for the influence of the school the child attended (for more detail, *see* Procedure for Nesting Effects).

Hypothesis 2. The relation between informant-based self-regulation and externalizing behavior

Hypothesis 2A Parent. Hypothesis 2A (parent) was that parent-rated executive function deficits, as measured by the subscales of the BRIEF parent form, would positively predict parent-reported externalizing behaviors (SSIS Parent Externalizing Problems Scale). Simultaneous multiple regression was used to test this hypothesis.

Hypothesis 2A Teacher. Hypothesis 2A (parent) was that teacher-rated executive Function deficits, as measured by the subscales of the BRIEF teacher form, would positively predict teacher-reported externalizing behaviors (SSIS Teacher Externalizing Problems Scale). Hierarchical multiple regression was used to test this hypothesis, while controlling for the influence of the school the child attended (for more detail, *see* Procedure for Nesting Effects).

Hypothesis 2B Parent. Hypothesis 2B (parent) was that parent-reported effortful control, as measured by the subscales of the CBQ Effortful Control parent scale, would

negatively predict parent-reported externalizing behaviors (SSIS Parent Externalizing Problems Scale). Simultaneous multiple regression was used to test this hypothesis.

Hypothesis 2B Teacher. Hypothesis 2B (teacher) was that teacher-reported effortful control, as measured by the subscales of the CBQ Effortful Control parent scale, would negatively predict teacher-reported externalizing behaviors (SSIS Teacher Externalizing Problems Scale). Simultaneous multiple regression was used to test this hypothesis. Hierarchical multiple regression was used to test this hypothesis, while controlling for the influence of the school the child attended (for more detail, *see* Procedure for Nesting Effects).

Hypothesis 3. The relation of social skills with externalizing behavior

Hypothesis 3 Parent. Hypothesis 3 (parent) was that parent-reported social skills, as measured by the subscales of the SSIS parent form, would negatively predict parent-reported externalizing problems (SSIS Externalizing Problems Scale). Simultaneous multiple regression was used to test this hypothesis.

Hypothesis 3 Teacher. Hypothesis 3 (teacher) was that teacher-reported social skills, as measured by the subscales of the SSIS parent form, would negatively predict teacher-reported externalizing problems (SSIS Externalizing Problems Scale). Hierarchical multiple regression was used to test this hypothesis, while controlling for the influence of the school the child attended (for more detail, *see* Procedure for Nesting Effects).

Culminating Question. The relations of self-regulation and social skills with externalizing behavior

Culminating Question 1) Parent. Culminating question 1 (parent) was: What are the unique contributions of all composite measures (NEPSY-II scales, TAT, BRIEF GEC, CBQ EC, and SSIS Social Skills) in relation to externalizing behaviors (SSIS Externalizing Problems Scale) for parent informants? Prior research has demonstrated that these composite measures have been individually predictive of externalizing problems, but it is unknown whether each variable has a unique contribution to externalizing problems when studied together. Simultaneous multiple regression was used to answer this question.

Culminating Question 1) Teacher. Culminating question 1 (teacher) was: What are the unique contributions of all composite measures (NEPSY-II scales, TAT, BRIEF GEC, CBQ EC, and SSIS Social Skills) in relation to externalizing behaviors (SSIS Externalizing Problems Scale) for teacher informants? Prior research has demonstrated that these composite measures have been individually predictive of externalizing problems, but it is unknown whether each variable has a unique contribution to externalizing problems when studied together. Hierarchical multiple regression was used to answer this question in order to control for the school the child attended.

Culminating Question 2) Parent. Culminating question 2 (parent) was: What are the unique contributions of the predictors identified as significant in hypotheses 1,2, and 3 in relation to externalizing behaviors (SSIS Externalizing Problems Scale) for parent informants? Question 2 (parent) differentiates from question 1 by only including the specific measures at the subscale level that were identified as significant predictors for parent-reported externalizing problems in prior analyses. Simultaneous multiple regression was used to answer this question.

Culminating Question 2) Teacher. Culminating question 2 (teacher) was: What are the unique contributions of the predictors identified as significant in hypotheses 1,2, and 3 in relation to externalizing behaviors (SSIS Externalizing Problems Scale) for teacher informants? Question 2 (teacher) differentiates from question 1 by only including the specific measures at the subscale level that were identified as significant predictors for teacher-reported externalizing problems in prior analyses. Hierarchical multiple regression was used to answer this question in order to control for the school the child attended.

Chapter 2: Methodology

Research Design

This study was part of a larger research project examining the associations between children's temperament, executive functioning, and social competence. Data collection began in January of 2012, and is currently ongoing. This study utilized a correlational design. Both performance measures and parent and teacher questionnaires were completed during the child's kindergarten school year.

Procedure

With prior IRB approval, researchers contacted private and public schools in the DC metro and Chicago areas to participate in the study. After obtaining consent from the school, research assistants recruited from classrooms of students beginning their kindergarten year. Data collection began in late fall to give teachers sufficient time to get to know their students. Packets with questionnaires were sent home using the parent mailbox and were hand-delivered to the teachers' classrooms. As part of this study, parents and teachers completed the appropriate version of the Behavior Rating Inventory of Executive Functions (BRIEF), the Children's Behavior Questionnaire-Short Form(CBQ-SF), and the Social Skills Improvement System (SSIS). Doctoral students serving as research assistants were trained to administer the Executive Function and Attention subtests of the NEPSY-II and the Thematic Apperception Test (TAT). The NEPSY-II subtests were administered in the traditional order: Auditory Attention, Design Fluency, Inhibition, and Statue. Testing typically occurred over two testing sessions lasting at least 30 minutes each. Children were asked for verbal assent prior to accompanying the researcher to the testing room.

Sample

The study included data collected from kindergarten children, their parents, and their teachers. Ten schools were included in this study. Eight schools were private schools, one school was a research-based school located on a university campus, and one school was a public school. For the purposes of the current study, separate samples were generated for students with complete parent scale data and for students with complete teacher scale data. Participants will be referred to as children for the following analyses. The majority of participants (n =84) were the same for both the parent and teacher dataset. This equates to 89% of the parent dataset and 83% of the teacher dataset.

Parent Dataset

The sample with complete parent data included 94 children. There were 55 male children (59%) and 39 female children (41%), ranging in age from 60 months to 83 months. The mean age of the sample was 69 months (SD=4.76). The sample included children from the following race/ethnicity: White (62%), Black (7%), Latino (10%), Asian (13%), and Other or Multi-racial (7%).

Teacher Dataset

The sample with complete teacher data included 101 children. For the teacher sample, participants were excluded if there was only one participant in the school due to the procedure for nesting effects discussed in the Data Analytic section. There were 58 male children (57%) and 43 female children (43%) included in this sample. Children ranged in age from 60 months to 79 months. The mean age of the sample was 69 months (SD=4.49). The sample included children from the following race/ethnicity: White

(63%), Black (7%), Latino (8%), Asian (12%), Other or Multi-racial (8%), and Unknown (2%).

The teacher sample included data from six schools. Children attended a research-based school located on a university campus (*n* =32), a private school in a large Midwestern City (*n* =20), two private schools in a Maryland suburb (*n* =38 and 4 respectively). a private school in Northern Virginia (*n* =3), and a suburban Maryland public school (*n* =4). The sample included data from 22 teachers. Teachers completed rating scales for a range of 2 students to 12 students in their class.

Measures

Executive Functions

A Developmental NEuroPSYchological Assessment: Second Edition (NEPSY-II; Korkman, Kirk, & Kemp, 2007). Kindergarten children were tested on the Attention and Executive Function domain of the NEPSY-II which comprise cognitive tasks requiring children to sustain attention, inhibit their responses, plan responses, and self-regulate. The following NEPSY-II subtests were administered: Auditory Attention, Design Fluency, Inhibition, and Statue. Tests were administered in the traditional order.

On the Auditory Attention task, the child listens to a series of words and touches the appropriate color circle when he or she hears the target word. To perform well on this task, the child must sustain attention, follow task directions, and inhibit the automatic response to respond to non-target words. On the Design Fluency task, the child is asked to generate as many unique designs as possibly by connecting up to five dots in one of two arrays (structured and random), each within a 60-second time limit. On the Inhibition task, the child looks at a series of black and white shapes or arrows and names either the

shape or direction (Naming) or the alternate response (Inhibition). For example, the child would respond "up" when they were shown a "down" arrow. The child must inhibit their automatic response in favor of a novel response to complete this task. A combined score is calculated based on the number of errors the child made and the total completion time for the task. On the Statue task, a child is asked to keep their eyes closed and maintain a body position during a 75-second period and to inhibit impulses to respond to various sound distractions made by the examiner.

Adequate reliability and validity has been demonstrated for the NEPSY-II Attention and Executive Functioning scales based on the Clinical and Interpretive Manual. Stability coefficients (test-retest methodology) were reported for these four scales because scores are based on item-level scores that are not strictly independent, due to either an allowed latency time or the use of speed of performance as a scoring criterion. For children 5 years, 0 months to 6 years, 11 months, the test-retest reliability coefficient was excellent for Auditory Attention Combined Scaled Score (.91), and Inhibition Combined Scaled Score (.96). For this age group, the reliability coefficient was good for Statue Total Score (.82). Finally, the reliability coefficient for this age group was lower for Design Fluency Total Score (.63). Importantly, the test-retest reliability for Design Fluency may have been impacted by practice effects (Korkman et al., 2007*)*. The test-retest reliability of the NEPSY-II scales could not be evaluated for the current sample, as all measures were only administered once with participants.

Behavior Rating Inventory of Executive Functioning (BRIEF; Roth, Isquith, & Gioia, 2005). Parents and teachers completed appropriate versions of the BRIEF for each participant, rating the frequency of the described behavior during the past six

months on a three-point scale **(***never*, *sometimes*, *often***).** Statements are negatively worded with high scores indicating low EF. The BRIEF includes two indices: the Behavioral Regulation Index (BRI) and the Metacognition Index (MCI). The BRI emphasizes behaviors relevant to social interactions, and includes the Inhibit, Shift, and Emotional Control subscales. The MCI emphasizes behaviors relevant to accomplishing tasks, and includes: Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor subscales. These two indices combine to form the Global Executive Composite (GEC) score. As indicated in the technical manual, parent and teacher forms have adequate reliability and validity, with high internal consistencies and high two-week test-retest reliability. Specifically, the internal consistency ranged from .80-.98 for parent and teacher forms and for clinical and normative samples. Two-week test-retest reliability for a normative subsample was .81 for the BRIEF Parent Form across clinical scales. Parent test-retest correlations were .84 for the BRI, .88 for the MCI, and .86 for the GEC. Two-week test-retest reliability for a normative subsample was .87 for the BRIEF Teacher Form. Teacher test-retest correlations were .92 for the BRI, .90 for the MCI, and .91 for the GEC (Gioia et al., 2000).

In the current study, the reliability was adequate for the Global Executive Composite (GEC) of the BRIEF parent scale (Cronbach's alpha=.95) and the BRIEF teacher scale (Cronbach's alpha=.98). The reliability was also adequate for all subscales of the BRIEF on both parent and teacher scales (see Appendix F).

Thematic Apperception Test (TAT; Teglasi, 2010). The TAT consists of pictures that depict people in ambiguous states of tension for which the individual is asked to create stories. The TAT has previously been used as a measure of EF in a study

conducted by Annotti and Teglasi (2017). In this study, the TAT EF scale is composed of the Level of Abstraction, Level of Perceptual-Conceptual Integration, and Level of Self-Regulation scales. In the present study, the TAT is conceptualized as a measure of "hot EF," because the task requires problem-solving to formulate a dilemma that fits the stimulus, recognize the emotional tensions faced by the story characters, and use reasoning to resolve the dilemma in ways that address both the problem and emotional issues. The narrator creates a storyline that integrates details that are noticed, while possibly modifying the initial approach in accord with his or her understanding of cause-effect connections (Teglasi, 2010). The individual's schemas guide the creation of the story.

The TAT defines EF as problem-solving that integrates prior knowledge with current information in order to prioritize goals and plan purposeful behavior, both in the moment and over time (Annotti & Teglasi, 2017). For the purposes of this study, specific sections of Teglasi's (2012) scoring system were used to assess kindergarteners' EF. The TAT does not provide the individual with strategies to resolve the pictured dilemma or inform the individual of what information is pertinent to resolving a problem. The narrator must independently determine what details in the picture to incorporate into the story, accurately interpret the pictured scene, and synthesize the information. Taken together, these levels assess the narrator's ability to understand cause-effect relations, attentional control, ability to plan, synthesize and organize information, ability to initiate and inhibit activity and thoughts, working memory, ability to self- monitor, and the ability to flexibly problem-solving based on integrating prior experience with current information.

The TAT Abstraction scale measures the extent to which the story transcends the isolated features of the stimulus picture, rather than focusing on minor or irrelevant details. TAT Abstraction is coded on the following scale: level one (piecemeal description of the stimulus), level two (literal description of the stimulus), level three (stimulus bound interpretation), and level four (abstract interpretation). The TAT Perceptual Integration scale measures the extent to which the child coordinates the details of the scene to the meaning of the scene in terms of accuracy, social causality, and psychological mindfulness. TAT Perceptual Integration is coded on the following scale: level one (discrepant), level two (literal), level three (superficial), level four (accurate), and level five (nuanced). The TAT Self-Regulation scale measures the extent to which the child's stories reflect real-world problem solving in the pursuit of long-term goals for self and community. TAT Self-Regulation is coded on the following scale: level one (dysregulation), level two (immediacy), level three (external direction), level four (internal direction), and level five (self-determination; Teglasi, 2010).

In a recent study, Annotti and Teglasi (2017) calculated the reliability of the TAT EF scale. A fixed effects ICC was calculated between two raters for absolute agreement and the results yielded the following reliability scores: .90 for the Level of Abstraction, .89 for the Level of Perceptual Integration, and .94 for the Level of Self-Regulation. ICC values $\geq .75$ represent excellent reliability (Shrout & Fleiss, 1979), thus the scores on the TAT between two raters were interpreted as highly reliable.

In the current study, the reliability was adequate for the TAT scales in both the parent and teacher datasets (see Appendix F). The Cronbach's alpha for the Abstraction scale was .87 for the parent dataset and .89 for the teacher dataset. The Cronbach's alpha

for the Perceptual Integration scale was .78 for the parent dataset and .82 for the teacher dataset. The Cronbach's alpha for the Self-Regulation scale was .86 for the parent dataset and .88 for the teacher dataset.

Effortful Control

Children's Behavior Questionnaire-Short Form (CBQ-SF; Putnam & Rothbart, 2006) and Teacher Version (CBQ-TSF; Teglasi, 2015). The CBQ-SF is a measure of temperament in early and middle childhood (ages 3-7 years). The measure was originally developed by Putnam and Rothbart to be completed by parents, and adapted by Teglasi for teachers. Factor analyses of the CBQ-SF and CBQ-TSF reliably recover a three-factor solution indicating three broad dimensions of temperament: Extraversion/Surgency, Negative Affectivity, and Effortful Control. The instructions direct the informant to "read each statement and decide whether it is a true or untrue description of the above-named child's reaction within the past six months." Parents and teachers rate the children according to a 7-point Likert scale that ranges from 1= extremely untrue of your child to 7 = extremely true of your child. The instructions also include a Not Applicable (N/A) option if the informant has never seen the child in the situation described. The Effortful Control scale will be used for the purposes of this study.

The CBQ-Short Form (Parent scale) Effortful Control subscales have demonstrated adequate reliability. According to Putnam and Rothbart (2006), Cronbach's alpha for the EC scales was adequate for the Inhibitory Control scale ($\alpha = .72$), and adequate for the Attentional Focusing subscale ($\alpha = .75$). In a study by Teglasi and colleagues (2015), the CBQ-TSF was distributed to preschool teachers and the internal

consistency of the effortful control scales was calculated using Cronbach's Alpha. Cronbach's alpha for the teacher EC scales was acceptable for the Inhibitory Control scale (α = .82), and adequate for the Attentional Focusing subscale (α = .79)

In the current study, the reliability was adequate for Children's Behavior Questionnaire (CBQ) parent Effortful Control scale (Cronbach's alpha=.79) and the teacher Effortful Control scale (Cronbach's alpha=.88). The reliability was also adequate for the subscales of Effortful Control on both parent and teacher scales, with the exception of the Low Intensity Pleasure scale on the parent form (see Appendix F).

Social Skills

Social Skills Improvement System: Social Skills Scale (SSIS; Gresham & Elliott, 2008). Parents and teachers completed the appropriate versions of the SSIS, rating the frequency of child behaviors during the past six months on a four-point scale (*never*, *seldom, often*, *almost always*). The Social Skills scale includes seven subscales, each representing a domain relevant for effective social interactions: Communication, Cooperation, Assertion, Responsibility, Empathy, Engagement, and Self-Control. These scales are combined to form a total Social Skills score.

According to the technical manual, the parent and teacher forms of the SSIS have adequate reliability and validity (Gresham & Elliott, 2008) for children ages 3-5 and 5-12, as well as solid test-retest reliability after a period of 43 to 61 days. Authors of the test reported internal consistency for the Total Social Skills score for children ages 5 to 12 as α = .97 for the Teacher Form and α = .95 for the Parent Form. The internal consistency for the Social Skills subscales for children ages 5 to 12 ranged from α = .83

to α = .92 for the Teacher Form, and ranged from α = .74 to α = .86 for the Parent Form (Gresham & Elliot, 2008, p. 66).

The test-retest reliability correlation for Social Skills scale was also moderately high on both the Teacher Form (*r* = .84), and Parent Form (*r* =.86), indicating that both raters' perception of social skills behaviors was fairly stable. The mean interval between ratings was 43 days for the Teacher Form and 61 days for the Parent Form (Gresham & Elliot, 2008, pp. 67-68).

In the current study, the Cronbach's alpha coefficient was adequate for the Total Social Skills scale of the SSIS Social Skills parent scale (Cronbach's alpha=.93) and SSIS Social Skills teacher scale (Cronbach's alpha=.96). The reliability was adequate (above .70) for all subscales of the SSIS parent form, with the exception of the Assertion scale. The reliability was adequate for all subscales of the SSIS teacher form (see Appendix F).

Externalizing Problems

Social Skills Improvement System: Externalizing Problems Scale (SSIS; Gresham & Elliott, 2008). Parents and teachers completed the appropriate versions of the SSIS, rating the frequency of child behaviors during the past six months on a four-point scale (*never*, *seldom, often*, *almost always*). The Externalizing Problems scale is a subscale of the Problem Behaviors scale of the SSIS. The scale is composed of 9 items on the parent form, and 12 items on the teacher form. Although the scale is named "Externalizing Problems," the term "externalizing behaviors" was used for all analyses, as this study utilized a community sample. The majority of items on the scale (6 for the parent version, 9 for the teacher version) represent active problem behaviors, such as

"fights others," while three items on the scale measure impulsive or reactive behaviors, such as "acts without thinking."

Authors of the test reported internal consistency for the Externalizing Problems score for children ages 5 to 12 as α = .93 for the Teacher Form and α = .90 for the Parent Form (Gresham & Elliot, 2008, page 66). The test-retest reliability correlation for Externalizing Problems scale was also moderately high on both the Teacher Form (*r* = .84), and Parent Form (*r* =.84), indicating that both raters' perception of externalizing behaviors was fairly stable. The mean interval between ratings was 43 days for the Teacher Form and 61 days for the Parent Form (Gresham & Elliot, 2008, p. 67-68). In the current study, the Cronbach's alpha coefficient was adequate for the Externalizing Problems scale on the parent form (Cronbach's alpha=.74) and the Externalizing Problems scale on the parent form (Cronbach's alpha=.86; see Appendix F)

Procedure for Missing Data

Only participants with complete performance data and questionnaire data were included in the current study. When items were incomplete on a questionnaire and attempts to contact the informant to complete were unsuccessful, a consistent procedure was used for missing items. If two or fewer items were missing on a subscale, the mean of the participant's score on that subscale was substituted for the missing item. This occurred for four participants in the parent sample (4.2%), and six participants in the teacher sample (5.9%). If more than two items were missing on a subscale, the variable was considered to be missing and the participant was not included in the study.

Data Analytic Plan

The study hypotheses built upon one another to test the differential predictors of self-regulation and social skills measures to externalizing problems. A series of analyses were conducted to consider the relations of each construct to externalizing behavior. The initial analyses examined the subscales of these broader constructs (e.g. how each subscale of the BRIEF is uniquely related to externalizing problems). The initial analyses (hypotheses 1,2, and 3) led to a culminating question which included the relations between the broader constructs of self-regulation and social skills to externalizing problems. Each hypothesis was tested separately within informant (parent and teacher). The hypotheses were examined using a multiple regression framework. Based on power analyses, the current size of the sample was sufficient to test all hypotheses (for detail, see *Power Analysis*).

Assumption Testing

There are five core assumptions of multiple linear regression: linearity, residual normality, independence of observations, no omitted variables, and homoscedasticity.

Linear relations between variables

The assumption of linearity was evaluated separately for each hypothesis according to visual inspection of graphical plots of the linear relations between the variables.

Normality of errors

The residuals from multiple regressions were examined separately for each hypothesis using graphical and Shapiro-Wilk tests in order to assess the assumption of normality.

Independence of observations

An assumption of multiple regression analysis is that observations are independent of one another. The current sample is random in that certain parents gave consent for their children to participate, and only those children participated in the study. As discussed previously, teacher effects were insignificant for all rating scale variables. Therefore, it can be concluded that observations were sufficiently independent to meet criteria for multiple linear regression. Additionally, school nesting was controlled for in the multiple regression analyses involving teacher data.

No omitted variables

The assumption that no variables were omitted appears to have been met. All relevant variables were included in this study for examining the child-level characteristics (executive functions, effortful control, and social skills) that predict externalizing problems based on previous research (*See* Literature Review). There were not omitted variables that would both be correlated with these predictors and predict externalizing problems. Although environmental factors such as poverty, parental abuse, or harsh discipline have been identified as predictors of externalizing problems in children, these variables if included would not be expected to change the relations among the predictors (executive functions, effortful control, and social skills) to the dependent variable (externalizing problems).

Homoscedasticity

The homoscedasticity assumption is that the variance of the error term is constant across all values of the independent variables in the regression model. The

homoscedasticity assumption was examined for each hypothesis graphically via plots of the residuals in the regression model against the independent variables.

Power Analysis

An a priori power analysis was conducted for each hypothesis in the current study. Statistical power is the probability of rejecting a null hypothesis when the null hypothesis is false. The sample size is chosen to keep power close to 0.80, with a significance level of .05. The specialized software program G*Power was utilized to calculate a priori power. For the maximum number of predictors in the study hypotheses (8 predictors), a sample size of 100 is required to determine an effect size of 0.25. This criterion was met for the teacher sample (n= 101), and approached for the parent sample (n=94).

Procedure for Possible Nesting Effects

The sample was evaluated for any nesting effects among teachers for the teacher dataset. To determine if there was any nesting effect, a one-way Analysis of Variance (ANOVA) was conducted to assess whether rating scale scores differed significantly by teacher report. This included teachers in the study who completed rating scales for at least 5 participants (n=8). Results indicated that there were no statistically significant differences in the mean CBQ effortful control scale, mean BRIEF GEC score, or mean Externalizing Problems score by teacher. However, there was a significant effect for the SSIS Social Skills scale by teacher (see Table 1).

Table 1

*Results of One-Way ANOVA Using Teacher as the Criterion****

Table 1 (Continued)

	CBQ Effortful Control	BRIEF GEC	SSIS Social Skills	SSIS Externalizing Problems
F-statistic	1.17	.31	2.38	.82
P-value	.34	.95	.03*	.58
Eta-squared (η^2)	.03	.04	.23	.09

Note. *$p < .05$; **$p < .01$

***Sample included the 8 teachers who rated at least 5 participants

The sample was also evaluated for any nesting effects among schools for the teacher dataset. To determine if there was any nesting effect, a one-way Analysis of Variance (ANOVA) was conducted to assess whether rating scale scores differed significantly by school for each of the three schools with five or more students. This included a total of 90 students, from the following schools: CYC (*n*=32), OLPH (*n*=20), and Woods (*n*=38). Results indicated that there were no statistically significant differences in the mean CBQ effortful control scale, mean BRIEF GEC score, mean SSIS Social Skills score, or mean Externalizing Problems score by school (see Table 2).

Table 2

*Results of One-Way ANOVA Using School as the Criterion**

	CBQ Effortful Control	BRIEF GEC	SSIS Social Skills	SSIS Externalizing Problems
F-statistic	.21	.97	1.25	.13
P-value	.81	.38	.29	.88

Table 2 (Continued)

Eta-squared (η^2)	.005	.02	.03	< .01

Note. $*p < .05$; $**p < .01$

*Sample included schools with at least five participants.

The means and standard deviations were also reported separately for each of the three schools with five or more students, for performance measures (see Table 3).

Table 3

Means and Standard Deviations of Performance Measures According to Schools

	CYC (*n*=32) M (SD)	OLPH (*n*=20) M (SD)	Woods (*n*=38) M (SD)
NEPSY-II Auditory Attention	10.75 (3.04)	10.65 (3.36)	9.71 (3.86)
NEPSY-II Design Fluency	6.94 (2.78)	9.90 (2.61)	8.08 (2.65)
NEPSY-II Inhibition	7.69 (3.84)	8.25 (4.54)	8.95 (3.49)
NEPSY-II Statue	10.06 (3.46)	10.60 (2.72)	10.76 (2.95)
TAT Abstraction	2.27 (.96)	2.30 (.92)	2.47 (.94)
TAT Perceptual Integration	2.43 (.80)	2.55 (.94)	2.43 (.67)
TAT Self-Regulation	2.28 (.74)	2.50 (.62)	2.24 (.78)

The means and standard deviations were also reported separately for each of the three schools with five or more students, for teacher rating scales (see Table 4).

Table 4

Means and Standard Deviations of Teacher Rating Scales According to Schools

	CYC (*n*=32) M (SD)	OLPH (*n*=20) M (SD)	Woods (*n*=38) M (SD)
BRIEF GEC Teacher	51.63 (9.58)	53.05 (13.65)	55.61 (13.05)
CBQ Effortful Control Teacher	4.73 (.72)	4.72 (.80)	4.84 (.82)
SSIS Social Skills Teacher	101.94 (11.85)	105.30 (15.36)	99.55 (13.15)
SSIS Externalizing Problems Teacher	5.66 (5.57)	5.10 (5.23)	5.84 (4.97)

Finally, the means and standard deviations were also reported separately for each of the three schools with five or more students, for parent rating scales (see Table 5).

Table 5

Means and Standard Deviations of Parent Rating Scales According to Schools

	CYC (*n*=27) M (SD)	OLPH (*n*=17) M (SD)	Woods (*n*=36) M (SD)
BRIEF GEC Parent	53.48 (7.76)	48.29 (10.53)	50.83 (8.81)
CBQ Effortful Control Parent	5.18 (.72)	5.57 (.64)	5.09 (.65)
SSIS Social Skills Parent	93.74 (13.91)	98.41 (12.72)	93.03 (11.64)

Table 5 (Continued)

SSIS Externalizing Problems Parent	8.04 (4.06)	6.71 (3.85)	8.92 (3.98)

To enable controls for potential nesting effects, the teacher sample did not include any schools with only one participant. For multiple regression analyses involving the teacher sample, the "school" variable was entered as a block of covariates before running the analysis.

Chapter 3: Results

Properties of Measures Within the Study

Means and standard deviations of the measures

The means, standard deviations, minimum, maximum, skewness, and kurtosis were computed for the performance measures in the parent dataset (see Table 6).

Table 6

Means and Standard Deviations of Performance Measures for Parent Dataset

Scale	Mean	SD	Minimum	Maximum	Skew	Kurtosis
NEPSY-II Auditory Attention*	10.00	3.55	1	18	-0.17	0.17
NEPSY-II Design Fluency*	7.98	2.90	2	14	0.03	-0.83
NEPSY-II Inhibition*	8.48	3.92	1	16	-0.40	-0.74
NEPSY-II Statue*	10.45	2.97	2	14	-1.07	0.64
TAT Abstraction**	2.27	0.89	1	4	0.02	-1.06
TAT Perceptual Integration**	2.33	0.80	1	5	0.39	0.42
TAT Self-Regulation**	2.25	0.68	1	4	0.36	-0.32

Notes.
*The NEPSY-II tasks are scaled scores, with a mean of 10, and standard deviation of 3.

** TAT scales are scored in the range of 1 to 4 for Abstraction, and 1 to 5 for Perceptual Integration and Self-Regulation

The means, standard deviations, minimum, maximum, skewness, and kurtosis were also computed for the performance measures in the parent dataset (see Table 7).

Table 7

Means and Standard Deviations of Performance Measures for Teacher Dataset

Table 7 (Continued)

Scale	Mean	SD	Min.	Max.	Skew	Kurtosis
NEPSY-II Auditory Attention*	10.18	3.48	1	18	-0.20	0.39
NEPSY-II Design Fluency*	7.97	2.83	2	14	-0.08	-0.73
NEPSY-II Inhibition*	8.51	3.81	1	15	-0.49	-0.73
NEPSY-II Statue*	10.30	3.12	1	14	-1.15	0.73
TAT Abstraction**	2.36	0.93	1	4	0.06	-1.02
TAT Perceptual Integration**	2.42	0.81	1	5	0.29	0.12
TAT Self-Regulation**	2.31	0.73	1	4	0.34	-0.60

Notes.
*The NEPSY-II tasks are scaled scores, with a mean of 10, and standard deviation of 3.

** TAT scales are scored in the range of 1 to 4 for Abstraction, and 1 to 5 for Perceptual Integration and Self-Regulation

The means, standard deviations, minimum, maximum, skewness, and kurtosis were computed for the rating scales in the parent dataset (see Table 8).

Table 8

Means and Standard Deviations of Parent Rating Scales

Scale	Mean	SD	Min	Max	Skew	Kurtosis
CBQ Effortful Control*	4.09	0.55	4.09	6.52	-0.24	-0.53
CBQ Attentional Focusing*	5.11	0.91	2.33	6.83	-0.65	-0.74
CBQ Inhibitory Control*	4.97	0.95	2.67	6.83	-0.34	-0.35
CBQ Low Intensity Pleasure*	5.82	0.59	4.25	7.00	-0.12	-0.44
CBQ Perceptual Sensitivity*	5.45	0.76	3.17	6.83	-0.70	0.34
BRIEF GEC**	51.60	8.30	34	75	0.46	0.01

Table 8 (Continued)

BRIEF Inhibit**	51.74	8.20	36	78	0.57	0.37
BRIEF Shift**	53.04	10.61	37	88	0.69	0.07
BRIEF Emotional Control**	51.18	9.33	35	80	0.26	-0.40
BRIEF Initiate**	50.18	8.95	35	74	0.39	-0.65
BRIEF Working Memory**	51.56	9.70	35	78	0.70	0.21
BRIEF Plan/Organize**	51.34	9.68	37	76	0.68	-0.28
BRIEF Organization of Materials**	50.83	9.36	32	73	0.41	-0.27
BRIEF Monitor**	50.01	9.87	32	76	0.38	-0.19
SSIS Social Skills***	95.13	13.15	56	128	0.05	0.88
SSIS Communication****	15.72	2.60	9	21	-0.05	-0.19
SSIS Cooperation****	12.62	2.50	7	18	0.12	0.15
SSIS Assertion****	14.38	2.86	8	20	-0.07	-0.59
SSIS Responsibility****	12.11	2.44	7	18	0.50	0.12
SSIS Empathy****	12.47	3.54	3	18	-0.25	-0.21
SSIS Engagement****	14.39	3.42	6	21	-0.12	-0.04
SSIS Self Control****	11.08	3.31	2	18	-0.11	0.25
SSIS Externalizing Problems****	8.02	3.94	0	19	0.43	0.49

Notes.
*CBQ scores range from 1 to 7, with a mean of 4

**BRIEF scales are T-scores, with a mean of 50 and standard deviation of 10

***The SSIS Social Skills scale is a standard score, with a mean of 100 and SD of 15

**** The SSIS subscales are scaled scores, with a mean of 10 and SD of 3

The means, standard deviations, minimum, maximum, skewness, and kurtosis were computed for the rating scales in the teacher dataset (see Table 9). Generally, the means and standard deviations (SD) were comparable to those found in a national sample.

Table 9

Means and Standard Deviations of Teacher Rating Scales

Scale	Mean	SD	Min.	Max.	Skew	Kurtosis
CBQ Effortful Control*	4.80	0.74	2.54	6.18	-0.64	0.27
CBQ Attentional Focusing*	4.96	1.13	1.50	6.67	-0.78	0.25
CBQ Inhibitory Control*	4.74	1.23	1.00	6.83	-0.80	0.47
CBQ Low Intensity Pleasure*	4.40	0.79	3.00	7.00	0.002	0.12
CBQ Perceptual Sensitivity*	4.60	1.07	1.50	6.67	-0.57	0.29
BRIEF GEC**	53.10	11.13	40	97	1.20	1.37
BRIEF Inhibit**	56.03	14.51	42	109	1.86	3.61
BRIEF Shift**	50.30	9.50	24	80	1.03	0.99
BRIEF Emotional Control**	53.37	15.62	43	125	2.26	5.36
BRIEF Initiate**	52.11	10.70	41	85	0.89	0.13
BRIEF Working Memory**	53.77	12.54	30	88	0.85	-0.06
BRIEF Plan/Organize**	50.76	10.44	25	79	0.95	0.60
BRIEF Organization of Materials**	51.02	8.44	41	84	1.56	2.14
BRIEF Monitor**	54.86	14.12	39	101	1.06	0.94
SSIS Social Skills***	100.73	13.06	67	130	0.04	-0.08
SSIS Communication****	15.95	3.07	7	21	-0.36	0.28
SSIS Cooperation****	12.2	3.49	4	18	-0.17	-0.57
SSIS Assertion****	13.23	3.40	5	21	0.02	-0.09
SSIS Responsibility****	12.94	3.27	5	18	-0.09	-0.37

Table 9 (Continued)

SSIS Empathy****	12.46	3.13	5	18	-0.17	-0.36
SSIS Engagement****	15.79	4.24	7	45	2.95	9.57
SSIS Self Control****	13.82	5.24	2	47	2.27	8.73
SSIS Externalizing Problems****	5.71	5.18	0	27	1.10	1.88

Notes
*CBQ scores range from 1 to 7, with a mean of 4

**BRIEF scales are T-scores, with a mean of 50 and standard deviation of 10

***The SSIS Social Skills scale is a standard score, with a mean of 100 and SD of 15

**** The SSIS subscales are scaled scores, with a mean of 10 and SD of 3

Gender effects

To evaluate possible gender effects, one-way Analysis of Variance (ANOVA) was conducted to assess whether parent rating scale scores (see Table 10) differed by gender. Results for the parent dataset indicated that there were no statistically significant differences in the mean CBQ effortful control scale, mean BRIEF GEC score, mean SSIS Social Skills score, or mean Externalizing Problems score by gender.

Table 10

Results of One-Way ANOVA using gender as the criterion, Parent Scales

	CBQ Effortful Control	BRIEF GEC	SSIS Social Skills	SSIS Externalizing Problems
F-statistic	.72	.01	.01	.003
P-value	.40	.91	.91	.96
Eta-squared (η^2)	.01	< .01	< .01	< .01
Cohen's d	0.20	< .20	< .20	0.20

Note. $*p < .05$; $**p < .01$

One-way Analysis of Variance (ANOVA) was also conducted to assess whether teacher rating scale scores (see Table 11) differed significantly by gender. Results for the teacher dataset indicated that there were no statistically significant differences in the mean CBQ effortful control scale, mean BRIEF GEC score, or mean Externalizing Problems score by teacher. However, there was a significant effect of gender for the SSIS Social Skills scale by teacher. The mean teacher Social Skills score was higher for females (Mean = 105.49) than for males (Mean =98.10). Hence, all analyses using this variable in the teacher dataset controlled for gender.

Table 11

Results of One-Way ANOVA using gender as the criterion, Teacher Scales

	CBQ Effortful Control	BRIEF GEC	SSIS Social Skills	SSIS Externalizing Problems
F-statistic	2.33	.329	8.56	1.14
P-value	.13	.568	.004**	.289
Eta-squared (η^2)	.02	< .01	< .01	.01
Cohen's d	0.29	< .20	< .20	0.20

Note. *p < .05; **p < .01

Correlations Among Measures at the Composite Level

Pearson correlations were calculated among the composite measures (NEPSY-II EF, TAT EF, BRIEF GEC, CBQ Effortful Control, SSIS Social Skills, and SSIS Externalizing Problems) for the parent dataset (see table 12). Correlations among composite measures within the parent dataset ranged from -.13 to .63, between the NEPSY-II EF and SSIS Social Skills and between the BRIEF GEC and SSIS Social Skills, respectively.

Table 12

Pearson correlations among composite measures, parent dataset

	NEPSY-II EF	TAT EF	BRIEF GEC	CBQ EC	SSIS Social	SSIS External.
NEPSY-II EF	1	.27**	-.28**	.33**	.008	-.13
TAT EF		1	-.23*	.19*	.17*	-.12
BRIEF GEC			1	-.49**	-.35**	.63**
CBQ Effortful Control				1	.40**	-.52**
SSIS Social Skills					1	-.41**
SSIS Externalizing Problems						1

Note. *p < .05; **p < .01

Pearson correlations were also calculated among the composite measures (NEPSY-II EF, TAT EF, BRIEF GEC, CBQ Effortful Control, SSIS Social Skills, and SSIS Externalizing Problems) for the teacher dataset (see table 13). Correlations among composite measures within the teacher dataset ranged from -.19 to .77, between the TAT and BRIEF GEC and between the BRIEF GEC and SSIS Social Skills, respectively.

Table 13

Pearson correlations among composite measures, teacher dataset

	NEPSY-II EF	TAT EF	BRIEF GEC	CBQ EC	SSIS Social	SSIS External.
NEPSY-II EF	1	.33**	-.49**	.36**	.31**	-.36**
TAT EF		1	-.19*	.31**	.33**	-.26**
BRIEF GEC			1	-.48**	-.55**	.77**
CBQ Effortful Control				1	.56**	-.61**
SSIS Social Skills					1	-.66**

Table 13 (Continued)

SSIS Externalizing Problems	1

Note. *$p < .05$; **$p < .01$

Correlations between hot and cool EF

Consistent with prior research (Annotti and Teglasi, 2017), there was a significant correlation between the NEPSY-II ("cool EF") composite and TAT EF ("hot EF") composite, which are both performance measures of executive functioning. This correlation was small for the parent dataset ($r = .27$) and moderate for the teacher dataset ($r = .33$).

Correlations between performance and informant measures of EF

The correlation between the NEPSY-II, a performance measure of cool EF, and the BRIEF GEC, a questionnaire measure of EF, was small for the parent dataset ($r = -.28$) and moderate for the teacher dataset ($r = -.49$). The correlation between the TAT, a performance-based measure of hot EF, and the BRIEF GEC, an informant-based measure of EF, was small for the parent dataset ($r = -.23$) and small for the teacher dataset ($r = -.19$). This was an inverse correlation, as the BRIEF GEC is a measure of EF deficits at home and at school.

Correlations between EF and EC

All of the EF measures, performance and informant-based, correlated with parent and teacher rated effortful control. The correlations were robust between the informant-measure of EF (BRIEF GEC) and informant measure of effortful control (CBQ EC). The correlation between the BRIEF GEC and CBQ EC was moderate for both the parent dataset ($r = -.49$) and for the teacher dataset ($r = -.48$). Children with more EF deficits at

home and at school were more likely to have lower levels of parent and teacher-reported EC, respectively.

There was a significant correlation between the NEPSY-II ("cool EF") and CBQ EC for the parent dataset (r = .33) and for the teacher dataset (r = .36). Children with higher levels of EF as measured by the NEPSY-II were more likely to have higher parent and teacher ratings of effortful control.

There was a significant correlation between the TAT ("hot EF") and CBQ EC that was small for the parent dataset (r =.19) and moderate for the teacher dataset (r =.31). Children with higher levels of EF as measured by the TAT were more likely to have higher parent and teacher ratings of effortful control.

Correlations between EF and social skills

There was not a significant correlation between the NEPSY-II ("cool EF") and parent-reported social skills. There was a significant correlation between the NEPSY-II ("cool EF") and teacher-reported social skills (r =.17). Children with higher levels of EF as measured by the NEPSY-II were more likely to have higher teacher ratings of social skills.

There was a significant correlation between the TAT ("hot EF") and parent-reported social skills (r =.17). There was a significant correlation between the TAT ("hot EF") and teacher-reported social skills (r =.33). Children with higher levels of EF as measured by the TAT were more likely to have higher parent and teacher ratings of social skills.

There was a moderate and significant correlation between the BRIEF GEC parent and SSIS Social Skills parent (r =-.35). There was a large and significant correlation

between the BRIEF GEC teacher and SSIS Social Skills teacher (r =-.55). This means that children with executive functioning deficits at home and at school were more likely to have lower social skills ratings as reported by parents and teachers, respectively.

Correlations between EC and social skills

There was a moderate and significant correlation between the CBQ Effortful Control parent scale and SSIS Social Skills parent scale (r =-.40). This means that children with higher levels of effortful control were more likely to be rated as having better social skills at home by parents. There was a large and significant correlation between the CBQ Effortful Control teacher scale and SSIS Social Skills teacher scale (r =-.56). This means that children with higher levels of effortful control were more likely to be rated as having better social skills at school by teachers.

Correlations of composite measures with externalizing problems

Finally, correlations were examined among all measures in relation to externalizing problems. In the parent sample, only informant measures of constructs were significantly correlated with externalizing problems. Parent-reported executive functioning deficits were significantly correlated with parent-reported externalizing behaviors (r =.63). Parent-reported effortful control was significantly negatively correlated with parent-reported externalizing behaviors (r =.52). Parent-reported social skills was significantly negatively correlated with parent-reported externalizing behaviors (r =-.41). In summary, children with more executive functioning deficits, lower effortful control, and lower social skills were more likely to display externalizing behaviors at home.

In the teacher sample, both performance and informant measures were significantly correlated with externalizing problems. The child's performance on the NEPSY-II EF tasks were negatively correlated with teacher-reported externalizing behaviors (r = -.36). The child's performance on the TAT task was also negatively correlated with teacher-reported externalizing behaviors (r = -.26). Teacher-reported executive functioning deficits were significantly correlated with teacher-reported externalizing behaviors (r =.77). Teacher-reported effortful control was significantly negatively correlated with teacher-reported externalizing behaviors (r=-.61). Teacher-reported social skills was significantly negatively correlated with parent-reported externalizing behaviors (r =-.66). In summary, children with lower EF task performance, greater executive functioning deficits, lower effortful control, and lower social skills were more likely to exhibit externalizing behaviors at school.

Correlations Among Subscales Within Each Measure

Pearson correlations were calculated among the subscales or subtests within each measure. These correlations are reported in table format in Appendix G. Correlations among the subscales of the NEPSY-II subtests were small, ranging from .17 to .29 across parent and teacher datasets. This pattern is in accordance with the NEPSY-II administration manual, which states that the subtests within each domain significantly vary in terms of stimulus presentation, administration requirements, response type, and scoring emphasis, and therefore, may not correlate highly with one another" (Korkman et al., 2007).

Correlations among the TAT scales were large, ranging from .54 to .77. Specifically, the correlation was lowest between the TAT Abstraction and TAT

Perceptual Integration scale for the parent sample (r =.54). The correlation was highest between the TAT Perceptual Integration and TAT Self-Regulation scale for the teacher sample (r = .77) Moderate to high correlations among the TAT scales is consistent with the overlap of these constructs and the descriptions for coding each scale (for more information, *see* Measures).

Correlations among the CBQ Effortful Control parent subscales were small to medium, ranging from .15 to .42 with higher correlations between the Attentional Focusing and Inhibitory Control scales. Correlations among the CBQ Effortful Control teacher subscales were small to large, ranging from .27 to .75, again, with the higher correlations between the Attentional Focusing and Inhibitory Control scales.

Correlations among the BRIEF parent subscales ranged from small to large, .08 to .73 with the higher correlation between the Working Memory and Plan/Organize scales. Correlations among the BRIEF teacher subscales ranged from .23 to .85 with the highest correlation between the Working Memory and Plan/Organize scales.

Correlations among the SSIS Social Skills parent subscales ranged from small to large,.24 to .70, with the highest correlation between the Responsibility and Cooperation scales. Correlations among the SSIS Social Skills teacher subscales ranged from small to large, .18 to .84, with the highest correlation between the Responsibility and Cooperation scales.

Correlations Between Parent and Teacher Scales

Pearson correlations were calculated between the same scales for parent informants and teacher informants. These correlations are reported in table format in Appendix H. Consistent with prior research, correlations between parent and teacher

ratings of the same composite scales were significant, but small, ranging from .25 for the SSIS Social Skills scale to .36 for the SSIS Externalizing Problems scale. Correlations between the same subscales within each measure for parents and teachers were also generally small to moderate, ranging from -.03 on the Shift scale of the BRIEF to .50 for the Inhibitory Control scale of the CBQ. It is important to note that these correlations of parent-teacher agreement should be considered in light of the reliabilities of each scale, as presented in Appendix F. For example, the only scale in the study that demonstrated a reliability of less than .7 was the CBQ Low Intensity Pleasure scale for parent informants (Cronbach's alpha = .62). The low parent-teacher agreement on this subscale (-.04) is affected by the reliability of this scale in the study.

Testing of the Hypotheses

There were no violations of the assumptions of normality, linearity, multicollinearity, and homoscedasticity for the multiple regression analyses.

Hypothesis 1. Relations of performance-based self-regulation with externalizing behavior

Hypothesis 1A Parent Sample. Hypothesis 1A (parent) was that "cool EF," as measured by the four NEPSY-II Executive Functioning scales (Auditory Attention, Design Fluency, Inhibition, and Statue), would negatively predict parent-reported externalizing behaviors (SSIS Parent Externalizing Problems Scale). Simultaneous multiple regression was used to test this hypothesis. Taken together, the NEPSY-II subscales did not significantly predict parent-reported externalizing problems. Although the NEPSY-II tasks are typically not composited in clinical assessment, the NEPSY-II composited EF score was also not significantly correlated with parent-reported externalizing problems (r = -.13). The NEPSY-II subscales explained 6.8% of the

variance in parent-reported externalizing problems, F (4, 89) =1.63, p = .17. When considering each independent variable, only the Statue subscale made a unique contribution to parent-reported externalizing behaviors (β= -.25, p < .05). The Statue subscale is a performance EF task, which measures the child's ability to follow directions and inhibit a pre-potent response. Lower values on the Statue task predicted higher levels of parent-reported externalizing behaviors. This hypothesis was minimally supported (see Table 14).

Table 14

Summary of Multiple Regression Analysis for Hypothesis 1A, NEPSY-II as a Predictor of Parent-rated Externalizing Behaviors

Variable	*B*	SE (*B*)	*β*	*t*	*P*	*r*
Auditory Attention	-.09	.12	-.08	-.76	.45	-.10
Design Fluency	.03	.15	.02	.17	.86	-.07
Inhibition	.09	.11	.09	.83	.41	.03
Statue	-.32	.14	-.25*	-2.27	.03	-.24*

Note. *p < .05; **p < .01

R^2 = .068

Hypothesis 1A Teacher Sample. Hypothesis 1A (teacher) was that "cool EF," as measured by the four NEPSY-II Executive Functioning scales (Auditory Attention, Design Fluency, Inhibition, and Statue) would negatively predict teacher-reported externalizing behaviors (SSIS Teacher Externalizing Problems Scale). Hierarchical multiple regression was used to test this hypothesis. The school the child attended was entered as Step 1 in the analysis, and the NEPSY-II scales were entered simultaneously as Step 2 in the analysis. The school the child attended explained a nonsignificant 1.9%

of the variance in teacher-reported externalizing problems. After entry of the Auditory Attention, Design Fluency, Inhibition, and Statue subtests at Step 2, the total variance explained by the model as a whole was 24.9%, F (5, 95) = 6.32, $p < .001$. The NEPSY-II measures explained an additional 23.1% of the variance in teacher-reported externalizing behaviors, after controlling for school, R squared change = .23, F change (4, 95) = 7.30, $p < .01$. Although the NEPSY-II tasks are typically not composited in clinical assessment, the NEPSY-II composited EF score was significantly and moderately correlated with teacher-reported externalizing problems (r = -.36).

In the final model, the Auditory Attention (β = -.23, p = .01), Design Fluency (β = -.31, $p < .01$), and Statue (β = -.17, $p < .05$) subscales made unique contributions to teacher-reported externalizing behaviors. The Auditory Attention, Design Fluency, and Statue subscales are performance EF tasks, which measure the child's ability to follow directions, complete a novel task and to inhibit a pre-potent response, respectively. Lower values on these tasks predicted higher levels of teacher-reported externalizing behaviors. Therefore, this hypothesis was mostly supported (see Table 15).

Table 15

Summary of Multiple Regression Analysis for Hypothesis 1A, NEPSY-II as a Predictor of Teacher-rated Externalizing Behaviors

Variable	*B*	SE (*B*)	*β*	*T*	*p*	*r*
School	-.31	.23	-.14	-1.37	.17	-.14
Auditory Attention	-.35	.14	-.23*	-2.49	.01	-.29**
Design Fluency	-.55	.17	-.31**	-3.19	.002	-.38**
Inhibition	.21	.12	.15	1.67	.01	.005
Statue	-.27	.15	-.17*	-1.75	.08	-.26**

Note. *$p < .05$; **$p < .01$

Model 1 R^2 = .019

Model 2 R^2 = .249**

Hypothesis 1B Parent Sample. Hypothesis 1B (parent) was that "hot EF," as measured by the three TAT scales (Abstraction, Perceptual Integration, and Self-Regulation) would negatively predict parent-reported externalizing behaviors (SSIS Parent Externalizing Problems Scale). When composited, the TAT scales were not significantly correlated with parent-reported externalizing problems (r = -.13). Simultaneous multiple regression was used to test this hypothesis. Taken together, the TAT scales did not significantly predict parent-reported externalizing behaviors. The TAT scales explained a non-significant 1.5% of the variance in parent-reported externalizing behaviors, F (3, 93) =.45, p = .72. When considering each independent variable, none of the TAT scales significantly predicted parent-reported externalizing behaviors. Therefore, this hypothesis was rejected (see Table 16).

Table 16

Summary of Multiple Regression Analysis for Hypothesis 1B, TAT as a Predictor of Parent-rated Externalizing Behaviors

Variable	*B*	SE (*B*)	*β*	*t*	*p*	*r*
TAT Abstraction	-.21	.59	-.05	-.36	.72	-.10
TAT Perceptual Integration	.03	.60	-.05	-.37	.71	-.09
TAT Self-Regulation	-.50	.98	-.09	-.51	.61	-.11

Note. *p < .05; **p < .01

R^2 = .015

Hypothesis 1B Teacher Sample. Hypothesis 1B (teacher) was that "hot EF," as measured by the three TAT scales (Abstraction, Perceptual Integration, and Self-

Regulation) would negatively predict teacher-reported externalizing behaviors (SSIS Teacher Externalizing Problems Scale). When composited, the TAT scales were significantly correlated with externalizing problems (r = -.26). Hierarchical multiple regression was used to test this hypothesis in order to control first for the influence of the school the child attended, which was entered as Step 1 in the analysis, and the TAT scales were entered simultaneously as Step 2. The school variable, entered at Step 1, explained a nonsignificant 1.9% of the variance in teacher-reported externalizing behaviors. After entry of the TAT Abstraction, Perceptual Integration, and Self-Regulation scales at Step 2, the total variance explained by the model as a whole was 10.4%, F (4, 96) = 2.79, p < .05. The TAT scales explained an additional 8.5% of the variance in teacher-reported externalizing behaviors, after controlling for school, R squared change = .085, F change (3, 96) = 3.05, p < .05. In the final model, none of the TAT subscales made unique separate contributions to teacher-reported externalizing behaviors. The TAT measure of hot EF measures the child's ability to engage in planning and self-monitoring to tell a story about a picture that depicts emotional tension. Lower values on the TAT predicted higher levels of teacher-reported externalizing behaviors. Therefore, this hypothesis was supported (see Table 17). Given the high correlations among the TAT scales, it is not surprising that none of the scales made a unique contribution.

Table 17

Summary of Multiple Regression Analysis for Hypothesis 1B, TAT as a Predictor of Teacher-rated Externalizing Behaviors

Variable	*B*	SE (*B*)	*β*	*t*	*p*	*r*
School	-.31	.23	-.14	-1.37	.17	-.14
TAT Abstraction	.53	.73	.10	.73	.47	-.15*

Table 17 (Continued)

TAT Perceptual Integration	-.91	.97	-.14	-.93	.35	-.26**
TAT Self-Regulation	-1.59	1.18	-.23	-1.3	.18	-.28**

Note. *$p < .05$; **$p < .01$

Model 1 $R^2 = .019$

Model 2 $R^2 = .104$*

Hypothesis 1C. Hypothesis IC was that "hot EF" and "cool EF" would jointly negatively predict externalizing behaviors (SSIS Externalizing Problems Scale). This was only examined for the teacher sample, because "hot EF," as measured by the TAT, was not a significant predictor for the parent sample. Hierarchical multiple regression was used to test this hypothesis in order to control first for the influence of the school the child attended, which was entered as Step 1 in the analysis. The NEPSY-II significant scales (Auditory Attention, Design Fluency, and Statue) and TAT EF composite were entered simultaneously as Step 2. The school variable, entered at Step 1, explained a nonsignificant 1.9% of the variance in teacher-reported externalizing behaviors. After entry of the NEPSY-II scales ("cool EF") and TAT EF composite ("hot EF") at Step 2, the total variance explained by the model as a whole was 23.8%, $p < .05$. The NEPSY-II scales and TAT EF explained an additional 21.9% of the variance in teacher-reported externalizing behaviors, after controlling for school, *R* squared change = .22. Taken together, lower levels of EF as measured by performance tasks significantly predicted higher levels of teacher-reported externalizing behaviors. In the final model, only the NEPSY-II Design Fluency task made a unique contribution to teacher-reported externalizing behaviors ($\beta = -.28$, $p < .01$). Lower values on the NEPSY-II Design

Fluency task, a measure of cognitive flexibility, predicted more teacher-reported externalizing behaviors.

Notably, the joint contribution of hot EF and cool EF did not explain more variance than cool EF alone, as cool EF explained 23.1% of the variance in teacher-reported externalizing problems in hypothesis 1B. Therefore, this hypothesis was not supported (see Table 18).

Table 18

Summary of Multiple Regression Analysis for Hypothesis 1C, "Hot EF" and "Cool EF" as Predictors of Teacher-rated Externalizing Behaviors

Variable	*B*	SE (*B*)	*β*	*T*	*p*	*r*
School	-.31	.205	-.137	-1.53	.13	-.14
NEPSY-II Auditory Attention	-.28	.14	-.19	-1.97	.05	-.29**
NEPSY-II Design Fluency	-.50	.17	-.28**	-2.92	.004	-.38**
NEPSY-II Statue	-.19	.16	-.12	-1.19	.24	-.26**

Note. *$p < .05$; **$p < .01$

Model 1 $R^2 = .019$

Model 2 $R^2 = .238$**

Hypothesis 2. Relations of informant-based self-regulation with externalizing behavior

Hypothesis 2A Parent Sample. Hypothesis 2A (parent) was that parent-rated executive function deficits, as measured by the subscales of the BRIEF parent form, would positively predict parent-reported externalizing behaviors (SSIS Parent Externalizing Problems Scale). Overall, parent-reported executive functions, as measured by the parent BRIEF Global Executive Composite (GEC) was significantly correlated with parent-reported externalizing behaviors ($r = .62$, $p < .01$). Simultaneous multiple

regression was used to test this hypothesis. Taken together, higher levels of parent-reported executive function deficits significantly predicted more parent-reported externalizing behaviors. The BRIEF parent subscales explained 45.1% of the variance in parent-reported externalizing behaviors, F (8, 85) =8.74, $p < .01$. Comparatively, the total score (BRIEF GEC parent) explained 38.9% of the variance in parent-reported externalizing behaviors, F (1, 92) =58.54, $p < .01$. Taken together, higher levels of parent-reported executive function deficits significantly predicted higher levels of parent-reported externalizing behaviors.

When considering each independent variable, the Inhibit (β = -.24, $p < .05$), and Emotional Control (β = -.11, $p < .05$) scales made unique contributions (see Table 19). The BRIEF subscales are measures of executive functioning deficits, with higher scores representing more EF deficits. Higher scores on the Inhibit scale are indicative of difficulties with controlling impulses and stopping behavior at the appropriate time. Higher scores on the Emotional Control scale are indicative of difficulties modulating emotional responses. Overall, higher scores on the Inhibit and Emotional Control scales were predictive of more parent-reported externalizing behaviors. Therefore, this hypothesis was supported.

Table 19

Summary of Multiple Regression Analysis for Hypothesis 2A, BRIEF Parent Scales as Predictors of Parent-rated Externalizing Behaviors

Variable	*B*	SE (*B*)	*β*	*T*	*P*	*r*
Inhibit	.11	.05	.24*	2.02	.04	.55**
Shift	.03	.04	.07	.66	.51	.41**
Emo. Control	.11	.05	.27*	2.48	.02	.52**

Table 19 (Continued)

Initiate	.03	.05	.08	.67	.50	.41**
Working Memory	.07	.06	.17	1.27	.21	.49**
Plan/Organize	.007	.06	.02	.12	.90	.41**
Org. of Materials	-.03	.04	-.07	-.71	.48	.25**
Monitor	.04	.05	.11	.84	.40	.47**

Note. *$p < .05$; **$p < .01$

$R^2 = .451$**

Hypothesis 2A Teacher Sample. Hypothesis 2A(teacher) was that teacher-rated executive function deficits, as measured by the subscales of the BRIEF teacher form, would positively predict teacher-reported externalizing behaviors (SSIS Teacher Externalizing Problems Scale). Overall, teacher-reported executive functions, as measured by the BRIEF teacher Global Executive Composite (GEC) was significantly correlated with teacher-reported externalizing behaviors ($r = .77$, $p < .01$). Hierarchical multiple regression was used to test this hypothesis in order to control first for the influence of the school the child attended. The school the child attended was entered as Step 1 in the analysis, and the BRIEF subscales were entered simultaneously as Step 2 in the analysis. School was entered at Step 1, explaining a nonsignificant 1.7% of the variance in teacher-reported externalizing problems. After entry of the BRIEF subscales at Step 2, the total variance explained by the model as a whole was 61.2%. The BRIEF scales explained an additional 59.4% of the variance in teacher-reported externalizing problems, after controlling for school, *R* squared change = .594, *F* change (8, 92) = 17.00, $p < .01$. Comparatively, the total score (BRIEF GEC teacher) explained 59% of

the variance in teacher-reported externalizing behaviors after controlling for the influence of school, F (2, 98) =72.17, $p < .01$. Taken together, higher levels of teacher-reported executive function deficits significantly predicted higher levels of teacher-reported externalizing behaviors.

When considering each independent variable, the Shift ($\beta = .31$, $p < .05$) and the Monitor ($\beta = .38$, $p < .05$) scales made a unique contribution (see Table 20). The BRIEF subscales are measures of executive functioning deficits, with higher scores representing more EF deficits. Higher scores on the Shift scale are indicative of difficulties in problem solving flexibly and transitioning between activities and tasks. Higher scores on the Monitor scale are indicative of difficulties in checking performance and the impact of one's behavior on others. Overall, higher scores on the Shift and Monitor scales were predictive of more teacher-reported externalizing behaviors. Therefore, this hypothesis was supported.

Table 20

Summary of Multiple Regression Analysis for Hypothesis 2A, BRIEF Teacher Scales as Predictors of Teacher-rated Externalizing Behaviors

Variable	*B*	SE (*B*)	*β*	*t*	*p*	*r*
School	-.30	.23	-.13	-1.30	.20	-.137
Inhibit	.08	.06	.20	1.36	.18	.61**
Shift	.17	.07	.31*	2.51	.01	.51**
Emo. Control	-.04	.04	-.13	-.99	.33	.46**
Initiate	-.04	.07	-.07	-.53	.60	.54**
Working Memory	.05	.06	.12	.90	.37	.56**
Plan/Organize	-.04	.09	-.07	-.43	.67	.58**
Org. of Materials	.11	.06	.18	1.77	.08	.60**

Table 20 (Continued)

Monitor	.16	.07	.38*	2.23	.03	.72**

Note. *$p < .05$; **$p < .01$

Model 1 $R^2 = .017$

Model 2 $R^2 = .61$**

Hypothesis 2B Parent Sample. Hypothesis 2B (parent) was that parent-reported effortful control, as measured by the subscales of the CBQ Effortful Control parent scale, would negatively predict parent-reported externalizing behaviors (SSIS Parent Externalizing Problems Scale). Overall, parent-reported effortful control, as measured by the CBQ parent effortful control scale, was significantly correlated with parent-reported externalizing behaviors (r =-.52, $p < .01$; accounting for 26.7% of variance). Simultaneous multiple regression was used to test this hypothesis. Taken together, the CBQ parent subscales significantly predicted parent-reported externalizing behaviors. The CBQ parent subscales explained 32.1% of the variance in parent-reported externalizing behaviors, F (4, 89) =10.29, $p < .01$. Taken together, lower levels of parent-reported effortful control significantly predicted higher levels of parent-reported externalizing behaviors.

When considering each independent variable, the Attentional Focusing (β = -.24, $p < .05$) and Inhibitory Control (β = -.41, $p < .01$) scales made unique contributions (see Table 21.) Lower scores on the Attentional Focusing scale indicate difficulties with maintaining attention to tasks. Lower scores on the Inhibitory Control scale indicate difficulties with suppressing inappropriate responses and planning for novel situations. Overall, lower scores on the Attentional Focusing and Inhibitory Control scales were

predictive of parent-reported externalizing behaviors. Therefore, this hypothesis was supported.

Table 21

Summary of Multiple Regression Analysis for Hypothesis 2B, CBQ Parent Effortful Control Scales as Predictors of Parent-rated Externalizing Behaviors

Variable	*B*	SE (*B*)	*β*	*t*	*p*	*r*
Attentional Focus	-1.01	.43	-.23*	-2.36	.02	-.41**
Inhibitory Control	-1.72	.43	-.41**	-4.04	.00	-.51**
Low Intensity Pleasure	.44	.66	.06	.67	.50	-.19*
Perceptual Sensitivity	-.69	.47	-.13	-1.46	.15	-.22*

Note. *$p < .05$; **$p < .01$

$R^2 = .32$**

Hypothesis 2B Teacher Sample. Hypothesis 2B (teacher) was that teacher-reported effortful control, as measured by the subscales of the CBQ Effortful Control teacher scale, would negatively predict teacher-reported externalizing behaviors (SSIS Teacher Externalizing Problems Scale). Overall, teacher-reported effortful control, as measured by the CBQ teacher effortful control scale, was significantly correlated with teacher-reported externalizing behaviors (r =-.60, $p < .01$; accounting for 35.8% of variance). Hierarchical multiple regression was used to test this hypothesis in order to control for the influence of the school the child attended. The school the child attended was entered as Step 1 in the analysis, and the CBQ subscales were entered simultaneously as Step 2 in the analysis. The school variable, explained a nonsignificant 1.3% of the variance in teacher-reported externalizing behaviors. After entry of the CBQ Effortful Control subscales at Step 2, the total variance explained by the model as a

whole was 47.2%. The CBQ scales explained an additional 45.9% of the variance in teacher-reported externalizing behaviors, after controlling for school, *R* squared change = .46, *F* change (4, 96) = 20.21, $p < .01$. Taken together, lower levels of teacher-reported effortful control significantly predicted higher levels of teacher-reported externalizing behaviors.

When considering each independent variable, the Attentional Focusing ($\beta = -.25$, $p < .05$) and Inhibitory Control ($\beta = -.47$, $p < .01$) scales made unique contributions (see Table 22.) Lower scores on the Attentional Focusing scale indicate difficulties with maintaining attention to tasks. Lower scores on the Inhibitory Control scale indicate difficulties with suppressing inappropriate responses and planning for novel situations. Overall, lower scores on the Attentional Focusing and Inhibitory Control scales were predictive of teacher-reported externalizing behaviors. Therefore, this hypothesis was supported.

Table 22

Summary of Multiple Regression Analysis for Hypothesis 2B, CBQ Teacher Effortful Control Scales as Predictors of Teacher-rated Externalizing Behaviors

Variable	*B*	SE (*B*)	*β*	*T*	*p*	*r*
School	-.28	.25	-.12	-1.14	.26	-.14
Attentional Focus	-1.12	.50	-.25*	-2.25	.03	-.60**
Inhibitory Control	-2.09	.49	-.47**	-4.23	.00	-.64**
Low Intensity Pleasure	-.59	.53	-.09	-1.12	.27	-.21*
Perceptual Sensitivity	.32	.40	.07	.78	.43	-.18*

Note. *$p < .05$; **$p < .01$

Model 1 $R^2 = .01$

Model 2 R^2 = .47**

Hypothesis 3. Relations of social skills with externalizing behavior

Hypothesis 3 Parent. Hypothesis 3 (parent) was that parent-reported social skills, as measured by the subscales of the SSIS parent form, would negatively predict parent-reported externalizing problems (SSIS Externalizing Problems Scale). Simultaneous multiple regression was used to test this hypothesis. Overall, parent-reported social skills, as measured by the SSIS Social Skills parent scale, were significantly correlated with parent-reported externalizing behaviors (r =-.41, p < .01; accounting for 17.1% of variance). Taken together, lower levels of parent-reported social skills significantly predicted higher levels of parent-reported externalizing behaviors. The SSIS Social Skills parent subscales explained 34.8% of the variance in parent-reported externalizing problems, F (7, 86) =6.56, p < .01.

When considering each independent variable, the Cooperation (β = -.35, p < .05) and Self Control (β = -.24, p < .05) scales made unique contributions (see Table 23.) The Cooperation scale measures a child's ability to work well with others and follow directions. The Self Control scale measures a child's ability to stay calm when provoked and tolerate others. Lower levels of parent-reported cooperation and self-control predicted more parent-reported externalizing problems. Therefore, this hypothesis was supported.

Table 23

Summary of Multiple Regression Analysis for Hypothesis 3, Parent-reported Social Skills as Predictors of Parent-reported Externalizing Behaviors

Variable	*B*	SE (*B*)	*β*	*t*	*p*	*r*
SSIS Communication	-.09	.18	-.06	-.50	.62	-.33**

Table 23 (Continued)

SSIS Cooperation	-.55	.21	-.35*	-2.58	.01	-.54**
SSIS Assertion	.01	.16	.01	.06	.95	-.06
SSIS Responsibility	-.19	.23	-.12	-.81	.42	-.45**
SSIS Empathy	-.03	.13	-.03	-.25	.81	-.32**
SSIS Engagement	.21	.15	.17	1.35	.18	-.15
SSIS Self-Control	-.28	.14	-.24*	-2.07	.04	-.44**

Note. *$p < .05$; **$p < .01$

$R^2 = .35$**

Hypothesis 3 Teacher. Hypothesis 3 (teacher) was that informant-reported social skills, as measured by the subscales of the SSIS teacher form, would negatively predict teacher-reported externalizing behaviors (SSIS Externalizing Problems Scale). Overall, teacher-reported social skills, as measured by the SSIS Social Skills scale, was significantly correlated with teacher-reported externalizing behaviors ($r = .62$, $p < .01$; accounting for 42.7% of variance). Hierarchical multiple regression was used to assess the ability of the SSIS Social Skills teacher subscales to predict teacher-reported externalizing behaviors in children (SSIS Externalizing Problems), after controlling for the influence of school and gender. Gender was used as a control in this analysis because there was a significant difference in teacher social skills ratings by gender. Specifically, the mean teacher Social Skills score was higher for females (Mean = 105.49) than for males (Mean =98.10). School and gender were entered at Step 1, explaining a non-significant 3.2% of the variance in teacher-reported externalizing behaviors. After entry of the SSIS social skills scales at Step 2, the total variance explained by the model as a whole was 60%, F (9,91) =14.99, $p < .01$. The SSIS social skills scales explained an

additional 56.8% of the variance in teacher-reported externalizing behaviors, after controlling for school and gender, *R* squared change = .57, *F* change (7, 90) = 18.26, $p <$ .01. Taken together, lower levels of teacher-reported social skills significantly predicted higher levels of teacher-reported externalizing behaviors.

In the final model, only the Cooperation scale ($\beta = -.40$, $p < .01$) and the Responsibility scale ($\beta = -.37$, $p < .05$) made unique contributions to teacher-reported externalizing behaviors (see table 24.) The Cooperation scale measures a child's ability to work well with others and follow directions. The Responsibility scale measures a child's ability to respect others and their belongings, and to own up to mistakes. Lower levels of teacher-reported cooperation and responsibility predicted more teacher-reported externalizing problems. Therefore, this hypothesis was supported.

Table 24

Summary of Multiple Regression Analysis for Hypothesis 3, Teacher-reported Social Skills as Predictors of Teacher-rated Externalizing Behaviors

Variable	*B*	SE (*B*)	*β*	*t*	*p*	*r*
School	-.33	.22	-.15	-1.45	.15	-.14
Gender	-1.18	1.03	-.11	-1.14	.26	-.10
SSIS Communication	-.08	.27	-.04	-.28	.78	-.61**
SSIS Cooperation	-.61	.20	-.40**	-3.02	.003	-.72**
SSIS Assertion	.23	.13	.15	1.77	.08	-.18*
SSIS Responsibility	-.60	.25	-.37*	-2.42	.02	-.70**
SSIS Empathy	-.17	.17	-.11	-1.02	.31	-.48**
SSIS Engagement	.10	.13	.08	.78	.44	-.12
SSIS Self-Control	-.03	.11	-.03	-.25	.80	-.28**

Note. *$p < .05$; **$p < .01$

Model 1 R^2 = .032

Model 2 R^2 = .60**

Culminating Question. Relations of self-regulation and social skills with externalizing behavior

Culminating Question 1) Parent. Simultaneous multiple regression was used to test the unique contributions of all composite measures (NEPSY-II scales, TAT, BRIEF GEC, CBQ EC, and SSIS Social Skills) in relation to externalizing behaviors (SSIS Externalizing Problems Scale) for parent informants. Taken together, the composite scales significantly predicted parent-reported externalizing behaviors. The composite scales explained 48.2% of the variance in parent-reported externalizing behaviors. When considering each independent variable, the BRIEF GEC parent scale (β = .48, p < .05), the global measure of executive functions, and the CBQ Effortful Control scale (β = -.26, $p < .01$), made unique contributions (see Table 25.) Higher levels of parent-reported executive function deficits and lower levels of parent-reported effortful control significantly predicted higher levels of parent-reported externalizing behaviors.

Table 25

Summary of Multiple Regression Analysis for Culminating Question 1, Parent Composite Scales and Externalizing Behaviors

Variable	*B*	SE (*B*)	*β*	*t*	*p*	*r*
NEPSY-II EF	.14	.16	.08	.89	.38	-.13
TAT EF	.25	.47	.04	.52	.60	-.12
BRIEF GEC Parent	.22	.04	.48**	5.23	< .01	.63**
CBQ EC Parent	-1.84	.70	-.26*	-2.64	< .01	-.52**
SSIS Social Skills Parent	-.05	.03	-.15	-1.72	.09	-.41**

Note. *$p < .05$; **$p < .01$

R^2 = .48**

Culminating Question 1) Teacher. Hierarchical multiple regression was used to test the unique contributions of all composite measures (NEPSY-II scales, TAT, BRIEF GEC, CBQ EC, and SSIS Social Skills) in relation to externalizing behaviors (SSIS Externalizing Problems Scale) for teacher informants, controlling for the school the child attended and gender. Gender was also used as a control in this analysis because there was a significant difference in teacher social skills ratings by gender. School and gender were entered at Step 1, explaining a non-significant 2.6% of the variance in teacher-reported externalizing behaviors. After entry of the composite measures at Step 2, the total variance explained by the model as a whole was 71.5%. The composite scales explained an additional 68.7% of the variance in teacher-reported externalizing behaviors, after controlling for school and gender.

In the final model, the BRIEF GEC teacher scale (β = .58, p < .01), the CBQ EC teacher scale (β = -.20, p < .01), and the SSIS Social Skills teacher scale (β = -.23, p < .01), made unique contributions to teacher-reported externalizing behaviors (see Table 26.) Higher levels of teacher--reported executive function deficits, lower levels of teacher-reported effortful control, and lower levels of teacher-reported social skills significantly predicted more teacher-reported externalizing behaviors.

Table 26

Summary of Multiple Regression Analysis for Culminating Question 1, Teacher Composite Scales and Externalizing Behaviors

Variable	*B*	SE (*B*)	*β*	*T*	*p*	*r*
School	-.19	.14	-.08	-1.36	.18	-.12
Gender	-.61	.63	-.06	-.96	.34	-.12

Table 26 (Continued)

NEPSY-II EF	.21	.17	.08	1.21	.23	-.36**
TAT EF	-.19	.44	-.03	-.42	.68	-.26**
BRIEF GEC Teacher	.27	.04	.58**	7.41	< .001	.77**
CBQ EC Teacher	-1.42	.52	-.20**	-2.73	.01	-.61**
SSIS Social Skills Teacher	-.10	.03	-.23**	-2.90	.01	-.66**

Note. *$p < .05$; **$p < .01$

Model 1 $R^2 = .026$

Model 2 $R^2 = .715$**

Culminating Question 2) Parent. Simultaneous multiple regression was used to test the unique contributions of the significant predictors in testing hypotheses 1, 2, and 3 in relation to externalizing behaviors (SSIS Externalizing Problems Scale) for parent informants. Only predictors that made significant unique contributions in previous parent analyses were included. For the parent analysis, this included the NEPSY-II Statue task, BRIEF Inhibit scale, BRIEF Emotional Control scale, CBQ Attentional Focusing scale, CBQ Inhibitory Control scale, SSIS Cooperation scale, and SSIS Self-Control scale. Taken together, these scales significantly predicted parent-reported externalizing behaviors. The measures explained 53.7% of the variance in parent-reported externalizing problems.

When considering each independent variable, the BRIEF Inhibit scale ($\beta = .25$, $p < .01$) and BRIEF Emotional Control scale ($\beta = .23$, $p < .05$) made unique contributions (see Table 27.) Higher scores on the Inhibit scale are indicative of difficulties with controlling impulses and stopping behavior at the appropriate time. Higher scores on the

Emotional Control scale are indicative of difficulties modulating emotional responses. Overall, higher scores on the Inhibit and Emotional Control scales were uniquely predictive of more parent-reported externalizing behaviors.

Table 27

Summary of Multiple Regression Analysis for Culminating Question 2, Parent Significant Scales and Externalizing Behaviors

Variable	*B*	SE (*B*)	*β*	*t*	*p*	*r*
NEPSY-II Statue	-.04	.11	-.03	-.34	.73	-.24**
BRIEF Inhibit	.12	.04	.25**	2.72	.01	.57**
BRIEF Emotional Control	.10	.04	.23*	2.35	.02	.52**
CBQ Attentional Focus	-.73	.37	-.17	-1.96	.05	-.41**
CBQ Inhibitory Control	-.62	.40	-.15	-1.56	.12	-.51**
SSIS Cooperation	-.22	.16	-.14	-1.40	.17	-.54**
SSIS Self-Control	-.13	.11	-.11	-1.17	.25	-.44**

Note. *$p < .05$; **$p < .01$

$R^2 = .54$**

A follow up analysis was conducted to examine if the measures in the model explained significant variance in parent-reported externalizing problems, beyond the Inhibit and Emotional Control scales. Hierarchical multiple regression was used for this analysis. The Inhibit and Emotional Control scales were simultaneously entered as Step 1 in the Model, explaining a significant 39.7% of the variance in parent-reported externalizing problems. The NEPSY-II Statue task, CBQ Attentional Focusing scale, CBQ Inhibitory Control scale, SSIS Cooperation scale, and SSIS Self-Control scale were entered as Step 2 in the model. After entry of these measures at Step 2, the total variance

explained in the model was 53.7%. These measures explained an additional significant 14% of the variance in parent-reported externalizing behaviors, after controlling for the BRIEF Inhibit and Emotional Control scales, *R* squared change = .14, $p < .01$ (see Table 28).

Table 28

Summary of Multiple Regression Analysis for Culminating Question 2 Follow Up, Parent significant scales and externalizing behaviors

Variable	*B*	SE (*B*)	*β*	*t*	*p*	*r*
BRIEF Inhibit	.12	.04*	.25**	2.71	< .01	.57**
BRIEF Emotional Control	.10	.04	.23*	2.35	.02	.52**
NEPSY-II Statue	-.04	.11	-.03	-.34	.73	-.24**
CBQ Attentional Focus	-.73	.37	-.17	-1.96	.05	-.41**
CBQ Inhibitory Control	-.62	.40	-.15	-1.56	.12	-.51**
SSIS Cooperation	-.22	.16	-.14	-1.40	.17	-.54**
SSIS Self-Control	-.13	.11	-.11	-1.17	.25	-.44**

Note. *$p < .05$; **$p < .01$

Model 1 R^2 =.397**

Model 2 R^2 =.537**

R^2 change = .14**

Culminating Question 2) Teacher. Hierarchical multiple regression was used to test the unique contributions of the significant predictors in testing hypotheses 1, 2, and 3 in relation to externalizing behaviors (SSIS Externalizing Problems Scale) for teacher informants, controlling for the school the child attended and gender. Gender was also used as a control in this analysis because there was a significant difference in teacher

social skills ratings by gender. Only predictors that made significant unique contributions in previous teacher analyses were included. For the teacher analysis, this included the NEPSY-II EF composite, TAT EF composite, BRIEF Shift scale, BRIEF Monitor scale, CBQ Attentional Focusing scale, CBQ Inhibitory Control scale, SSIS Cooperation scale, and SSIS Responsibility scale. School and gender entered at Step 1, explaining a non-significant 2.6% of the variance in teacher-reported externalizing behaviors. After entry of the previous significant predictors at Step 2, the total variance explained by the model as a whole was 72.7%.

In the final model, the BRIEF Shift scale ($\beta = -.22$, $p < .01$), the BRIEF Monitor scale ($\beta = .31$, $p < .01$), and the SSIS Responsibility scale ($\beta = -.21$, $p < .05$) made unique contributions to teacher-reported externalizing behaviors (see Table 29). Higher scores on the Shift scale are indicative of difficulties in problem solving and transitioning between activities and tasks. Higher scores on the Monitor scale are indicative of difficulties in checking performance and the impact of one's behavior on others. Higher scores on the Responsibility scale indicate respect for others and belonging. Overall, higher scores on the Shift and Monitor scales and lower scores on the SSIS Responsibility scale were uniquely predictive of higher levels of teacher-reported externalizing behaviors.

Table 29

Summary of Multiple Regression Analysis for Culminating Question 2, Teacher Significant Scales and Externalizing Behaviors

Variable	*B*	SE (*B*)	*β*	*T*	*p*	*r*
School	-.17	.14	-.07	-1.23	.22	-.11
Gender	-.40	.63	-.04	-.64	.52	-.11
NEPSY-II EF	.11	.17	.04	.67	.50	-.35**
TAT EF	.15	.44	-.02	-.33	.74	-.26**

Table 29 (Continued)

BRIEF Shift	.12	.04	.22**	3.38	< .01	.54**
BRIEF Monitor	.13	.03	.32**	3.75	< .01	.73**
CBQ Attentional Focus	-.04	.42	< .01	-.09	.93	-.59**
CBQ Inhibitory Control	-.56	.43	-.12	-1.30	.20	-.65**
SSIS Cooperation	-.29	.19	-.19	-1.57	.12	-.73**
SSIS Responsibility	-.35	.16	-.21*	-2.11	.04	-.70**

Note. *$p < .05$; **$p < .01$

Model 1 $R^2 = .026$

Model 2 $R^2 = .729$**

A follow up analysis was conducted to examine if the other measures in the model explained significant variance in teacher-reported externalizing problems, beyond the Shift, Monitor, and Responsibility scales. Hierarchical multiple regression was used for this analysis. School and gender were simultaneously entered as Step 1 in the analysis, explaining a non-significant 2.8% of the variance in teacher-reported externalizing problems. The BRIEF Shift, BRIEF Monitor, and SSIS Responsibility scales were simultaneously entered as Step 2 in the analysis, explaining a significant 69.9% of the variance in teacher-reported externalizing problems. The NEPSY-II EF composite, TAT EF composite, CBQ Attentional Focusing scale, CBQ Inhibitory Control scale, and SSIS Cooperation scale were simultaneously entered as Step 3 in the analysis. After entry of these measures at Step 3, the total variance explained in the model was 72.7%. These measures explained a non-significant 2.8% of the variance in teacher-reported externalizing behaviors, *R* squared change =.03 (see Table 30).

Table 30

Summary of Multiple Regression Analysis for Culminating Question B Follow Up, Teacher significant scales and externalizing behaviors

Variable	*B*	SE (*B*)	*β*	*t*	*p*	*r*
School	-.17	.14	-.07	-1.25	.22	-.11
Gender	-.40	.63	-.04	-.64	.52	-.11
BRIEF Shift	.12	.04	-.22**	3.42	< .01	.54**
BRIEF Monitor	.12	.03	.31**	3.71	< .01	.73**
SSIS Responsibility	-.37	.16	-.23**	-2.30	.02	-.70**
NEPSY-II EF	.10	.17	.04	.63	.53	-.35**
TAT EF	-.18	.43	-.03	-.40	.69	-.26**
CBQ Attentional Focus	-.01	.42	< .01	-.01	.99	-.59**
CBQ Inhibitory Control	-.55	.42	-.12	-1.30	.20	-.65**
SSIS Cooperation	-.30	.19	-.20	-1.63	.11	-.73**

Note. *$p < .05$; **$p < .01$

Model 1 $R^2 = .026$

Model 2 $R^2 = .699$**

Model 3 $R^2 = .727$**

R^2 change = .028

Supplementary analyses

Follow Up Parent ANOVA: Differences between High Externalizing Behavior and Comparison Groups. A follow up analysis was conducted to examine the differences in all composite variables for the group of children rated with the highest number of externalizing problems by parents in the sample (top 15%), in relation to a

comparison group, which comprised the remainder of the sample. One-way between-groups analysis of variance was performed to investigate differences between children rated by parents as high and lower in externalizing behaviors in each composite scale. The independent variable groupings, low/high externalizing behavior, were defined as follows: the high group comprised children at the highest 15% of the sample on the SSIS Externalizing Problems Parent scale (n =14) and the comparison group comprised the remainder of the sample (n =80). Separate ANOVAs were performed for the following dependent variables: NEPSY-II EF, TAT EF, BRIEF GEC Parent, CBQ Effortful Control Parent, and SSIS Social Skills Parent.

There was a statistically significant difference in the NEPSY-II EF scores for the two externalizing behavior groups: F (1, 92) = 4.5, p = .04. The effect size calculated using Cohen's d was .46 (eta-squared = .05).

There was not a statistically significant difference in the TAT EF scores for the two externalizing behavior groups: F (1, 92) = 1.2, p = .27.

There was a statistically significant difference in the BRIEF GEC Parent scores for the two externalizing behavior groups: F (1, 92) = 28.07, p < .01. The effect size calculated using Cohen's d was 1.09 (eta-squared = .23).

There was a statistically significant difference in the CBQ Effortful Control Parent scores for the two externalizing behavior groups: F (1, 92) = 16.05, p < .01. The effect size calculated using Cohen's d was .84 (eta-squared = .15).

There was a statistically significant difference in the SSIS Social Skills Parent scores for the two externalizing behavior groups: F (1, 92) = 9.38, p < .01. The effect size calculated using Cohen's d was .63 (eta-squared = .09).

Therefore, children had significant differences in their scores on the NEPSY-II EF, CBQ EC Parent, BRIEF GEC Parent, and SSIS Social Skills parent scores by group. Children in the comparison group of lower externalizing behavior had significantly higher levels of EF as measured by the NEPSY-II tasks, less executive functioning deficits as measured by the BRIEF GEC parent, higher levels of effortful control as measured by the CBQ EC parent, and higher levels of social skills as measured by the SSIS Social Skills parent. Conversely, children in the high externalizing behavior group had significantly lower levels of EF as measured by the NEPSY-II tasks, more executive functioning deficits as measured by the BRIEF GEC parent, lower levels of effortful control as measured by the CBQ EC parent, and lower levels of social skills as measured by the SSIS Social Skills parent.

Follow Up Teacher ANOVA: Differences between High Externalizing Behavior and Comparison Groups. A follow up analysis was conducted to examine the differences in all composite variables for the group of children rated with the highest number of externalizing problems by teachers in the sample (highest 15%) in relation to a comparison group of the remaining students. A one-way between-groups analysis of variance was performed to investigate differences in each composite scale for higher externalizers and a comparison group as rated by teachers. The independent variable was the low/high externalizing behavior group. The higher externalizing behavior group was defined as the highest 15% of the sample on the SSIS Externalizing Problems Teacher scale (n =15). The comparison group was the remainder of the sample (n =86). Separate ANOVAs were performed for the following dependent variables: NEPSY-II EF, TAT

EF, CBQ Effortful Control Teacher, BRIEF GEC Teacher, and SSIS Social Skills Teacher.

There was a statistically significant difference in the NEPSY-II EF scores for the two externalizing behavior groups: F (1, 99) = 7.7, $p < .01$. The effect size calculated using Cohen's d was .56 (eta-squared = .08).

There was a statistically significant difference in the TAT EF scores for the two externalizing behavior groups: F (1, 99) = 4.3, $p < .05$ The effect size calculated using Cohen's d was .41 (eta-squared = .04).

There was a statistically significant difference in the BRIEF GEC Teacher scores for the two externalizing behavior groups: F (1, 99) = 64.8, $p < .01$. The effect size calculated using Cohen's d was 1.63 (eta-squared = .40).

There was a statistically significant difference in the CBQ Effortful Control Teacher scores for the two externalizing behavior groups: F (1, 99) = 24.8, $p < .01$. The effect size calculated using Cohen's d was 1(eta-squared = .20).

There was a statistically significant difference in the SSIS Social Skills Teacher scores for the two externalizing behavior groups: F (1, 99) = 31.98, $p < .01$. The effect size calculated using Cohen's d was 1.12 (eta-squared = .24).

Therefore, children had significant differences in their scores on the NEPSY-II EF, TAT EF, BRIEF GEC Teacher, CBQ EC Teacher, and SSIS Social Skills Teacher scores by group. Children in the comparison group had significantly higher levels of EF as measured by the NEPSY-II and TAT tasks, less executive functioning deficits as measured by the BRIEF GEC Teacher, higher levels of effortful control as measured by the CBQ EC Teacher, and higher levels of social skills as measured by the SSIS Social

Skills Teacher. Conversely, children in the high externalizing behavior group had significantly lower levels of EF as measured by the NEPSY-II and TAT tasks, more executive functioning deficits as measured by the BRIEF GEC Teacher, lower levels of effortful control as measured by the CBQ EC Teacher, and lower levels of social skills as measured by the SSIS Social Skills Teacher.

Summary of Key Results

A summary of key results is presented in table 31 for the significant predictors of externalizing behaviors and their correlation to externalizing problems for parent and teacher informants. In this table, bolded measures were significant predictors of externalizing behaviors within the set (hypothesis) and bolded and italicized measures were unique predictors in the final model including all composite measures.

As shown in the table, there were differences in the findings for parents and teachers for performance measures of EF. The NEPSY-II Statue task significantly predicted both parent and teacher-reported externalizing behaviors. The NEPSY-II Auditory Attention task and the NEPSY-II Design Fluency task predicted teacher-reported externalizing behaviors. The TAT EF Composite predicted teacher-reported externalizing behaviors, but not parent reported externalizing behaviors.

The BRIEF GEC composite, a measure of EF deficits, predicted both parent-reported and teacher-reported externalizing behaviors, and was a unique predictor in the final model including all composite measures across parent and teacher informants. Different subscales of the BRIEF emerged as unique predictors for parent informants versus teacher informants, however. The Inhibit and Emotional Control subscales were

uniquely predictive of parent-reported externalizing behaviors, while the Shift and Monitor subscales were uniquely predictive of teacher-reported externalizing behaviors.

The CBQ EC composite, a measure of effortful control, predicted both parent-reported and teacher-reported externalizing behaviors, and was a unique predictor in the final model including all composite measures across parent and teacher informants. The same two subscales of the CBQ EC scale, Attentional Focusing and Inhibitory Control, significantly predicted externalizing behaviors within each informant.

The SSIS Social Skills composite, a measure of social skills, predicted both parent-reported and teacher-reported externalizing behaviors, but was a unique predictor in the final model including all composite measures for teacher informants only. The Cooperation scale was a unique predictor across parent and teacher informants. The Self Control subscale was uniquely predictive of parent-reported externalizing behaviors only, while the Responsibility subscale was uniquely predictive of teacher-reported externalizing behaviors only.

Table 31

Summary of key findings, All significant predictors of externalizing behaviors and their correlations with externalizing behaviors

	Parent-Reported Externalizing Behaviors		Teacher-Reported Externalizing Behaviors	
	Significant Predictors	*r*	Significant Predictors	*r*
NEPSY-II	**Statue**	-.24*	**Statue**	-.26**
			Auditory Attention	-.29**
			Design Fluency	-.38**
TAT	None		TAT EF	-.25**

Table 31 (Continued)

BRIEF Executive Functions	***BRIEF GEC***	.63**	***BRIEF GEC***	.77**
	Inhibit	.56**	***Shift***	.51**
	Emo. Control	.52**	***Monitor***	.72**
CBQ Effortful Control	***CBQ EC***	-.52**	***CBQ EC***	-.61**
	Att. Focus	-.41**	**Att. Focus**	-.59**
	Inh. Control	-.51**	**Inh. Control**	-.64**
SSIS Social Skills	**SSIS Social Skills**	-.41**	***SSIS Social Skills***	-.66**
	Cooperation	-.54**	**Cooperation**	-.72**
	Self-Control	-.45**	**Responsibility**	-.69**

Note. *$p < .05$; **$p < .01$

Bolded scales were unique contributors in the set

Bolded and italicized scales were unique scales in the final model

Chapter 4: Discussion

The key aim of this study was to examine the relations of self-regulation (executive functions and effortful control) and social skills to externalizing problems as rated by parents and teachers. Previous research on this topic has typically either utilized a measure of externalizing problems from only one informant (e.g. parent or teacher), or composited the results from parents and teachers into one variable to differentiate a "problem group" from the "control group" (Schoemaker et al., 2013, see Appendix E). In this study, relations were examined among constructs within each informant (parent and teacher).

The concern with compositing results from parents and teachers is that research has consistently documented "informant discrepancies," or differences between ratings from different informants (Meyer et al., 2001). Specifically, correlations between informants tend to be low, especially between informants who view a child in different settings, such as parents and teachers (Achenbach et al., 1987). As expected, there was low agreement between parent and teachers in this study. Correlations between the same parent and teacher scales were low to moderate, ranging from .25 to .36 for composite scales. Notably, and consistent with prior research (Sofia Major et al., 2018), there was higher agreement between parents and teachers for students at the extreme end of externalizing behaviors, representing the top 15% of the total sample. Of the top 15% of children identified by parents and teachers separately, parents and teachers identified the same 7 children, which accounts for 46.7% agreement.

When correlations between parents and teachers are low, or when parents and teachers identify different referral concerns for children, it does not necessarily mean that

one informant's report of the child's behavior is invalid. Rather, it could be that there is useful information to be gained from each informant, and that differences in informant ratings reflect real differences in the child's behavior in different contexts (De Los Reyes et al., 2009). Another reason for informant discrepancies is that teachers have a greater reference point for normative behavior at a particular age. They can compare a child to his or her peers in the classroom when completing a rating scale for that child. Parents do not have this comparison sample and may have less knowledge of what is considered typical or normative behavior at a certain age (Major et al., 2018).

Consistent with the theory that parent and teacher differences are meaningful, parallel analyses were conducted in this study for parent informants and for teacher informants. Specifically, the relations of EF, EC, and social skills with externalizing problems were examined within each informant (parent and teacher) rather than compositing scores. Conducting parallel analyses allows for understanding how these variables are related to one another in each context (home and school). Importantly, this study demonstrated that there are both similarities and differences in how EF, EC, and social skills relate to externalizing behaviors when measured by parent informants versus teacher informants (see Table 31 for summary of key findings).

This study also differentiated from previous research by utilizing both performance and informant measures of EF. Within informants, correlations between constructs were moderate to high when both constructs were assessed with the same method of measurement (e.g. both measured with a rating scale), but lower when constructs were assessed with different methods of measurement (e.g. a performance task with a rating scale). This finding reiterates the importance of considering criterion

validity, or how well a certain measure predicts an outcome for another measure, and has implications for the types of measurement to use for different purposes, including research, screening, and intervention (Toplak et al. 2013).

Finally, this study differentiated from previous research by examining the variables of EF, EC, and social skills together, and examining all measures at both the composite level and the subscale level. Previous research has largely studied similar self-regulatory constructs from isolated fields, such as executive functions from the field of neuroscience (Bridgett et al. 2013) and effortful control from the field of temperament (Rothbart & Bates, 2006). The benefit of including these constructs in one study is that it allows for a better understanding of the contributions that each variable makes to externalizing problems while controlling for other predictors.

Previous research on the relations of EC, EF, and social skills to externalizing problems in young children has often utilized composite scales when considering parent and teacher reports, such as the Effortful Control scale of the CBQ or the Global Executive Composite of the BRIEF (Blair et al., 2004). This study was novel in that the hypotheses built on one another to test the predictors of externalizing problems at both the composite and subscale level. This is important because specific subscales of the BRIEF, CBQ, and SSIS Social Skills scales uniquely predicted externalizing problems for parent informants and teacher informants. Examining the unique contributions of subscales provides more information about the specific constructs that predict externalizing behaviors in young children in each context.

Similarities in Parent and Teacher Predictors of Externalizing Behaviors

There are key similarities in the predictors of externalizing behaviors for parent and teacher informants. First, parents and teachers demonstrated similar findings at the composite level for rating scale measures of EF and EC. Consistent with prior research (Blair et al., 2004), greater EF deficits, as measured by the BRIEF, predicted more externalizing behaviors in children according to both parent and teacher reports. Additionally, lower effortful control on the CBQ predicted more externalizing behaviors in children according to both parent and teacher reports (see Culminating Question 1).

Second, the Cooperation subscale of the SSIS was a common significant and unique predictor of externalizing behaviors for both parent and teacher informants (see Hypothesis 3). The Cooperation scale measures a child's ability to work well with others and to follow directions. Children who were rated with lower cooperation skills presented with more externalizing behaviors across home and school contexts. This finding is consistent with a recent review of studies conducted with children ranging from ages 3 to 6 that early externalizing symptoms are accompanied by lower levels of prosocial behavior, which includes helping or cooperating with others (Huber et al., 2019). Notably, however, the review by Huber and colleagues did not compare any differences between and parent and teacher informants. Theoretically, the ability to cooperate is an important skill for demonstrating appropriate behaviors at both home and school. At home, children who follow the instructions of their parents and get along well with their siblings would be less likely to display externalizing behaviors such as disobeying parents or fighting with siblings. At school, children who follow the directions of the

teacher and work well with their peers would also be less likely to disobey school staff or get in conflicts with their peers.

Third, the same subscales of the CBQ EC (Attentional Focusing and Inhibitory Control) were significant and large predictors for externalizing behaviors as reported by both parents and teachers (see Hypothesis 2B). The Attentional Focusing scale measures attention to task. Few studies have examined the role of attentional focusing specifically to externalizing problems. One study found that attentional control in kindergarten was a significant predictor of later externalizing problems at grade 3 for both parent and teacher reports, but only for children who also exhibited negative emotionality (Eisenberg and colleagues, 2000). The current study further supports the theory that low attentional control is predictive of externalizing problems. Attentional control may theoretically help children to regulate negative emotional experiences in order to suppress externalizing behaviors across home and school contexts.

The Inhibitory Control scale measures the ability to suppress an inappropriate response. Inhibitory Control has been linked to externalizing problems in young children in previous research. Specifically, poor inhibitory control predicts higher externalizing problems for older preschoolers and kindergarten children when mother and teacher reports are aggregated (Utendale & Hastins, 2011). Inhibitory Control can be theoretically linked to externalizing behaviors across home and school settings. Children who are unable to suppress an automatic response, especially when provoked, would also be more likely act out with externalizing behaviors at both home and at school. For example, if a child is provoked by a peer or sibling accidentally bumping into them and is

low in inhibitory control, they may act out in ways such as pushing the peer or sibling back.

Finally, the NEPSY-II Statue task was a common significant and unique predictor of externalizing behaviors for both parent and teacher informants (see Hypothesis 1A). The Statue task is a measure of inhibition. This task measures a child's ability to follow instructions and suppress an automatic response to move, open their eyes, or verbalize when hearing a distracting noise. Inhibition, similar to Inhibitory Control, is theoretically an important skill across settings, because a child would be more likely to act out in externalizing behaviors if unable to suppress their automatic responses. In support of this, the EF of inhibition has shown the strongest relations to externalizing problems across studies of preschool-age children (Schoemaker et al, 2013).

Differences in Parent and Teacher Predictors of Externalizing Behaviors

There are also key differences in the predictors of externalizing behaviors for parent and teacher informants. First, parents and teachers differed regarding social skills as a unique predictor to externalizing problems, after accounting for effortful control and executive functions (see Culminating Question 1). At the composite level, low total social skills predicted more externalizing problems across informants. However, low total social competence was a *unique* contributor to externalizing problems, when also accounting for EF and EC, for teacher informants only. Theoretically, social skills may be uniquely predictive in the school setting only because children need to regularly interact with multiple peers and adults, whereas they only interact with parents and possibly siblings in the home environment. For children at-risk for externalizing problems, social skills

interventions may be especially important to implement when problems are identified in the school setting than when problems are identified in the home setting only.

Second, there were differences in patterns at the subscale level for the specific social skills that predicted externalizing problems in children (see Hypothesis 3.) As stated previously, lower cooperation was a significant predictor of both parent and teacher-reported externalizing problems. For parent but not teacher informants, lower self-control was also a unique predictor of externalizing problems in children. Self-control is conceptually similar to externalizing behaviors, as these behaviors inherently represent a lack of control over behavior. For teacher, but not parent informants, lower responsibility was a unique predictor of externalizing problems. Responsibility includes respecting others and their property, and accepting consequences. This may be more important in the school setting as kindergarten children need to share and respect the property of their peers. More research is warranted to better understand why these specific social skills may be important for regulating behaviors in home versus school contexts.

Third, there were differences in patterns for the specific executive functions that predicted externalizing problems for parents versus teachers (see Hypothesis 2A.) Generally, executive functions that involved some degree of cognitive regulation were predictive of externalizing problems according to teacher report, while executive functions related to behavioral regulation were predictive of externalizing problems according to parent report.

For the BRIEF, deficits on the Inhibit and Emotional Control scales uniquely predicted more parent-reported externalizing behaviors. These scales are related to

behavior regulation, specifically the ability to inhibit an automatic response and modulate emotional reactions. Comparatively, deficits on the Shift and Monitor scales of the BRIEF uniquely predicted more teacher-reported externalizing behaviors. Shifting may be more important to regulating behavior in the school setting because there are many transitions between classes and activities in the classroom. Monitoring is the ability to check one's performance and influence of their behaviors on others. Children who struggle to transition or are unaware of the influence of their behavior on others may be more likely to demonstrate externalizing behaviors at school.

There were also different patterns in the relations of performance measures of EF to externalizing behaviors by informant (see Hypothesis 1). As stated previously, difficulties with the NEPSY-II Statue task was a common predictor of both parent and teacher-reported externalizing problems. None of the other EF performance measures, including the NEPSY-II subtests or TAT, significantly predicted parent-reported externalizing behaviors. Comparatively, the NEPSY-II Auditory Attention, NEPSY-II Design Fluency, and TAT EF each significantly predicted teacher-reported externalizing behaviors.

Interpreting Findings in Relation to Denham (2012)'s Model

In the model of self-regulation proposed by Denham (2012), there are three key components of self-regulation: cognition, emotion, and behavior. In addition, Denham's findings show that the cognitive, emotional, and behavioral aspects of self-regulation are each important factors, but inextricably linked for young children at this age. In this study, the cognitive aspect of self-regulation was measured with the NEPSY-II scales, the emotional aspect of self-regulation was measured by the TAT scales, and the behavioral

aspect of self-regulation was measured by the BRIEF GEC and CBQ EC scales.Although the behavioral component of self-regulation emerged as significant in the final model across parent and teacher informants, it is important to note the differences in measurement, as cognitive and emotional domains were measured with performance tasks while the behavioral domain was measured with rating scales.

Overall, differences in findings for parents and teachers in this study revealed that executive functions involving more cognitive regulation appear to be more predictive of externalizing behaviors as reported by teachers only. Cool EF performance tasks of Auditory Attention and Design Fluency were predictive of teacher-reported externalizing behaviors, but not parent-reported externalizing behaviors, require children to sustain attention throughout a task, plan their responses, and generate novel solutions. These performance tasks may correspond more with work completion in the classroom and how children approach novel tasks. At the kindergarten age, these skills may be less important to the home setting.

Issues in Measurement: Performance Measures Versus Rating Scales of EF in Relation to Externalizing Behaviors

This study utilized multiple measures of EF: the NEPSY-II as a performance measure of "cool EF", the TAT as a performance measure of "hot EF", and the BRIEF GEC parent and teacher forms as rating scale measures of executive functioning deficits in real-world settings. Correlations between the NEPSY-II and BRIEF GEC were small for the parent dataset, and moderate for the teacher dataset. Correlations between the TAT and BRIEF GEC were small for both the parent and teacher dataset. This is consistent with prior research documenting low correlations between performance and

informant measures of EF (Toplak et al., 2013). Performance EF was still relevant to other constructs. The NEPSY-II EF tasks were moderately correlated with effortful control for parent-report, and the TAT EF was moderately correlated with social skills for teacher report.

In this study, externalizing behaviors were also measured by a rating scale completed by parents and teachers. Correlations between measures of EF and externalizing problem behaviors were moderate to high when both were measured with the same method. There was a high correlation between the BRIEF GEC and teacher-reported externalizing problems, as compared to a low correlation between the TAT EF and externalizing problems, and low to medium correlations between the NEPSY-II tasks and externalizing problems. When all variables were examined at the composite level in Culminating Question 1, global deficits in executive functions as measured by the BRIEF GEC accounted for the most variance in externalizing problems for both parent and teacher informants. Notably, the BRIEF GEC and SSIS Externalizing Problems scale both are negatively worded and measure behaviors or skills that are problematic, which also helps to explain the high correlations between these two scales across informants.

Method variance is widely acknowledged in research, and continues to pose challenges for both researchers and practitioners. Performance measures such as the NEPSY-II Statue are considered *maximal* because there are well-defined expectations for behavior. Rating scales such as the SSIS are considered *typical* because they measure a child's behavior in everyday settings, which often have less defined expectations for behavior (Annotti & Teglasi, 2017). As kindergarten classrooms are often highly

structured, performance on maximal tasks such as the NEPSY-II may be more predictive of externalizing behaviors in the school setting as compared to the home setting.

Reconciling Informant Discrepancies

Low agreement between informants is common, especially for informants who view the child in different settings such as parents and teachers (Achenbach et al., 1987). A recent meta-analysis obtained a mean correlation of parent-teacher agreement of 0.28 (De Los Reyes et al., 2015). Consistent with this research, results of this study also indicated low agreement between parents and teachers for children's effortful control, social skills, and executive functions.

The highest correlation between parents and teachers, though still moderate, was the SSIS Externalizing Problems scale (r = .36). This is consistent with research that parents and teachers tend to agree more on externalizing behaviors than internalizing behaviors (Achenbach et al., 1987). Externalizing behaviors are likely more available to be observed across home and school settings because they are outward displays of problem behavior that defy social rules, conventions, and expectations. Consistent with prior research (Sofia Major et al., 2018), parents and teachers showed higher levels of agreement for children at the extremes in this study. Even at the extreme levels, however, parents and teachers both identified the same 7 of the highest 15 children for externalizing problems in each sample (46.7% agreement).

Research shows that informant discrepancies can reflect real differences in the child's behavior across settings (De Los Reyes et al., 2009). For example, if a child's parent reports high externalizing problems at home but teachers report low externalizing problems at school, it does not mean that only one informant is correct and the other

informant is biased. The child may demonstrate more significant behavior problems in the home setting as a result of their familiarity and comfort with the caregiver.

Informant discrepancies may also occur due to differences in *trait relevance* and *functional equivalence* (Teglasi et al., 2017). According to the realistic accuracy model (RAM) proposed by Funder (1995), traits that are more relevant to a particular setting are more likely to be expressed, and therefore more available to be observed in that setting. Informants are also more likely to notice and recall traits that are important to the setting when completing questionnaires about a student. To interpret informant discrepancies between parents and teachers, it helps to understand the relevance of a particular trait and its functional equivalence for home and school settings.

As an example, the Organization of Materials scale on the BRIEF assesses a child's ability to be orderly in their work and storage spaces. In this study, the child's difficulties with organizing materials as reported by parents had a small correlation with parent-reported externalizing problems (r =.25), whereas the child's difficulties with organizing materials as reported by teachers had a large correlation with teacher-reported externalizing problems (r =.60). Organization of materials is likely more relevant to functioning in the school setting because a child needs to organize all of their classroom materials and share a space with multiple peers.

Limitations

There are four key limitations of this study. First, this study utilized a correlational and cross-sectional design. The predictor measures of EF, EC, and social skills were administered at the same time as the measure of the dependent variable (externalizing behaviors). As these variables were not examined longitudinally, the study

could not account for any long-term effects of EF, EC, or social skills in relation to externalizing problems. More research using a longitudinal design is warranted on this topic to better understand how these variables may predict externalizing behaviors across development. Second, the sample size in this study was relatively small. There were 94 participants in the parent sample, and 101 participants in the teacher sample. There is limited generalizability for the follow up analyses in this study that examined the differences between the top 15% of each sample on the Externalizing Problem scale because only 15 children were included in this group. Third, the participants in the study sample do not represent the diversity of a national sample. The majority of participants in the sample attended private schools or a research-based school on a University campus. This limits the generalizability of this study when compared to children attending public schools and children from different levels of socioeconomic status. In addition, there was not significant representation of black and brown students in the sample. For example, black students accounted for only 7% of the parent sample and teacher sample. Finally, environmental factors that have been identified as risk factors for externalizing problems were not examined in this study. Both family-level factors such as harsh discipline, abuse, and neglect (Gathright & Tyler, 2014), and school-level factors, such as student-teacher relationships and school disciplinary policies, are related to externalizing behaviors in children (Novak, 2019).

Conclusions and Implications

In conclusion, results of this study indicate that there is low agreement between parents and teachers on measures of self-regulation, social skills, and externalizing problems, but that agreement is higher for children rated at the extreme ends of problem

behavior. There are both similarities and differences in the relations of self-regulation and social skills to externalizing problems for home and school settings. Greater informant-reported global EF deficits, low ratings of global social skills, and low effortful control are predictive of more externalizing behaviors across parent and teacher informants. Differences were observed at the subscale level for the specific EF deficits and social skills that uniquely predicted parent-reported versus teacher-reported externalizing problems. Additionally, many performance measures of EF, including the NEPSY-II scales and the TAT, significantly predicted teacher-reported externalizing behaviors, but not parent-reported externalizing behaviors. Overall, relations are moderate to high between constructs when both are assessed with the same informant and method of measurement.

There are important implications of this study for both researchers and practitioners. For researchers, it is important to understand the realities of informant discrepancies when conducting research across parent and teacher informants. A recent model developed by Sofia Major and colleagues (2018) provides researchers with a new way to account for parent and teacher disagreement. In this approach, researchers can use latent profile analysis to identify clusters for different level of parent-teacher agreement, and examine results within each cluster. When examining associations between self-regulation and externalizing problems, researchers also need to carefully define and operationalize overlapping constructs, such as executive functions and effortful control. Finally, researchers can use the *maximum* and *typical* continuum of measurement to understand why performance measures and rating scales of EF show low correlations

with one another and may tap into different constructs (Annotti & Teglasi, 2007; Toplak et al. 2013).

For practitioners, this study has important implications for clinical assessment, screening children at-risk for externalizing problems, and interventions for children at-risk. In the area of clinical assessment, practitioners can seek to understand differences in informant reports by considering the relevance and functional equivalence of traits to the home and school settings (Teglasi et al., 2017). For clinical assessment, it is recommended that practitioners utilize multiple methods of measurement across informants to gain a whole picture of the child. Patterns of bivariate correlations with externalizing problems in this study demonstrated that multiple areas of executive functioning, effortful control, and social skills are significantly correlated with externalizing problems across settings.

At the same time, practitioners can identify skills that are most salient for each setting (home and school) by examining the subscales that were uniquely predictive of externalizing problems (see Table 31). These findings highlight skills that are particularly relevant and important for the display of socially appropriate behavior at home versus school. For example, in the area of executive functions, inhibition and emotional control significantly and uniquely predicted externalizing problems at home, whereas the ability to shift between tasks and monitor behavior significantly and uniquely predicted externalizing problems at school. These subscales may be particularly important to assess when screening children at-risk for externalizing problems in each setting. When developing interventions for children at-risk, practitioners would also benefit from focusing on the specific skills important to functioning in each setting. For example,

when designing a social skills intervention for children-at risk for externalizing problems at school, a practitioner could target the social skills that significantly predicted externalizing behaviors in this study (cooperation and taking responsibility for one's actions).

Given that externalizing behaviors are the most prevalent mental health problem for kindergarten children (Campbell, 1995) and can be predictive of later juvenile delinquency, adult crime, and violence (Liu, 2004), more research is needed on the specific self-regulatory components and social skills that predict externalizing problems at a young age. Importantly, there are multiple pathways in which childhood externalizing problems could predict adult crime and violence. For example, the school to prison pipeline is an expansive and documented problem where systemic factors such as zero tolerance policies, racial bias, and the presence of school resource officers funnel children out of public schools and into the juvenile and criminal justice system (Novak, 2019). As child resilience has been identified as a protective factor (Glenn, 2019), self-regulation and social skills may also serve as protective factors for children. Future longitudinal research can examine if EF, EC, and social skills may serve as protective factors for youth at-risk for involvement with the justice system.

Future research in this area can also seek to explain informant discrepancies among parents and teachers, and why different aspects of executive functions, effortful control, and social skills are particularly important for the display of socially appropriate behavior in each setting. Longitudinal research can also help to identify the self-regulatory and social skills that predict externalizing problems at different stages of development.

Appendix A

Definitions of Self-Regulation in the Literature, Organized from Broad to Narrow

Definitions of Self-Regulation	Citation
the internal and transactional processes that individuals use to guide their goal-directed behavior over time and in various contexts	Karoly, 1993
cognitive and behavioral processes that allow individuals to maintain optimal levels of emotional, motivational, and cognitive arousal for adaptation	Liew, 2012
an individual's ability to control their emotional, cognitive, and motivational arousal in a manner that encourages the development of successful emotion, cognitive, and academic outcomes	Blair & Diamond, 2008
attributes such as focusing and maintaining attention, regulating emotion and stress response physiology, reflecting on information and experience, and engaging in sustained and positive social interactions with teachers and peers	Blair & Raver, 2015
the primarily volitional management of arousal or activity in attention, emotion, and stress response systems in ways that facilitate the use of executive function abilities in the service of goal-directed actions	Ursache, Blair & Raver, 2008

Appendix B

How different research fields operationalize self-regulation

Field	Construct	Definition
Neuroscience	Executive functions	"higher level cognitive processes which help individuals engage in organized, goal-oriented behavior" (Bridgett, Oddi, Laake, Murdock, & Bachmann, 2013)
Temperament	Effortful control	"ability to inhibit a dominant, prepotent response to perform a subdominant, less salient response and to detect errors" (Rothbart & Bates, 2006)
Human development	Behavioral regulation	"the manifestation of executive function skills in observable responses in the form of children's gross motor actions" (Ponitz, McClelland, Matthews, & Morrison, 2009)

Appendix C

Examples of measures of executive functions

Domain	Example measure	Description
Interviews	Structured and semi-structured interviews with students, parents, and teachers (McCloskey and Perkins, 2012)	Uses a funneling technique involving three phases: open-ended questions, general questions about EF, and specific functions about EF.
Observation	Executive Functions Student Observation Form (EFSO; McCloskey, Perkins, & Van Divner, 2009)	Observer indicates the presence or absence of the child's self-regulation EF in the classroom and in interactions with the teacher, for specific areas, such as Perceive, Initiate, and Inhibit.
Tests of cognition	NEPSY-II (Korkman, Kirk, & Kemp, 2007): Attention and Executive Function domain	Subtests of the NEPSY-II (Animal Sorts, Design Fluency, Inhibition, Statue, Auditory Attention) measure specific components of EF.
Behavior rating scales	Behavior Rating Inventory of Executive Functions (BRIEF; Roth, Isquith, & Gioia, 2014)	The BRIEF has forms to be completed by the child, parent, and teacher. Statements are in the negative, indicating lack of executive functions. The informant rates the frequency of a behavior occurring in the past 6-months.

Appendix D

Associations between self-regulation and developmental outcomes

Outcome (+/-)	Reference
Academic skills (+)	Allan, N. P., Hume, L. E., Allan, D. M., Farrington, A. L., & Lonigan, C. J. (2014)
Math and reading achievement (+)	Ponitz, C. C., McClelland, M. M., Matthews, J. S., & Morrison, F. J. (2009)
Classroom adjustment (+)	Denham, S. A., Bassett, H. H., Zinsser, K., & Wyatt, T. M. (2014)
Adaptive behavior in school (+)	Rimm-Kaufman, S. E., Curby, T. W., Grimm, K. J., Nathanson, L., & Brock, L. L. (2009)
Social skills (+)	Liew, J. (2012)
School readiness (+)	Blair, C., & Raver, C. C. (2015)
Experience of socially challenging situations (-)	Kurki, K., Järvelä, S., Mykkänen, A., & Määttä, E. (2015)
Internalizing problems (-)	White, B.A., Jarrett, M.A. & Ollendick, T.H. (2013)
Externalizing behaviors(-)	Shoemaker, Mulder, Dekovic, and Matthys (2012)

Appendix E

Studies in Meta-analysis of EF and Externalizing Problems for Preschool Children

Eight studies in the Schoemaker et al (2013) meta-analysis of EF and externalizing problems included a measure from both parents and teachers of externalizing problems. The results are summarized in the table below regarding the sample, measure of externalizing problems, use of parent/teacher ratings, and measure of EF and effect size. Measures of EF were categorized into inhibition, working memory, and cognitive flexibility tasks. Importantly, studies did not analyze patterns in findings separately for parents and teachers, but rather used some type of combination of parent and teacher ratings/interviews to differentiate groups in the study.

Citation	N (% male)	Sample	Measure of Ext. Behaviors	Use of Parent/ Teacher Ratings	Measure of EF and Effect Size
1. Berwid et al. (2005)	16 high risk ADHD (64%) 42 low risk ADHD (63%)	Community	Parent and teacher DSM-IV ADHD symptom checklist	Children were determined as high or low risk for ADHD if met the symptom cut-off for either parent OR teacher	***Inhibition*** GoNoGo: 0.21 Stroop task: 0.16
2. Brocki et al (2007)	72 ADHD and/or ODD (83%)	1/3 selected by psychologist	Parent and Teacher Quest. of ADHD and ODD symptoms	Noted high correlations between parent and teacher informants and used	***Inhibition*** NEPSY Statue: 0.47

					the mean score for analyses.	Knock/tap: 0.42 GoNoGo: 0.37 ***Working memory*** Digit Span Forward:0.13 Digit Span Backward: 0.06 Spatial Memory: 0.07
3.	Campbell et al (1994)	69 Hard to manage (100%) 43 control (100%)	¼ selected by parents/diagnosed	SNAP Questionnaire (Teacher) Parent-identified (diagnosed or reported)	Noted that groups were collapsed, as parent and teacher-identified boys demonstrated similar performance on behavioral measures.	***Inhibition*** Resistance to temptation: 0.36 Delay of gratification: 0.19
4.	Hughes et al (1998)	40 Hard to manage (60%) 40 control (60%)	Community	Parent Strengths and Difficulties Quest. Teacher interviews	Teachers were interviewed, and children were identified as “hard to manage” if	***Inhibition*** Detour reaching box: 0.30 Luria’s handgame: 0.23

					interviews corroborated parental ratings.	***Working memory*** Noisy book: 0.19 ***Cognitive Flexibility*** Card sorting: 0.17
5.	Mariana and Barkley (1997)	24 ADHD (100%) 30 Control (100%)	Referred	Parent or teacher quest. Parent interview	Parent and teacher ratings were combined to separate ADHD group from control group.	***Working memory*** Digit span: 0.35 Selective reminding: 0.42 Spatial memory: 0.43 ***Cognitive Flexibility*** Color form test: 0.23
6.	Perner et al (2002)	24 At-risk ADHD 22 Control	Community	ADHD Rating Scale IV (Teacher) At-risk and control groups were then formed. Parents were given the ADHD Rating Scale IV questions in an interview format	Noted that parental ratings correspond ed well with the scoring by the teachers concerning global risk status, but children were dropped from control group if received a positive	***Inhibition*** NEPSY Statue: 0.36 Knock and Tap: 0.21 GoNoGo: 0.31 ***Working memory*** Digit span backward: 0.12

					rating by their parents.	
7.	Re et al (2010)	23 ADHD (61%) 23 Control (61%)	Community	Parent and Teacher Italian Early Ident. of ADHD Rating Scale, interviews	Children were sorted into either ADHD group or control group based on symptom counts. Noted that informal interviews supported these categories.	***Working memory*** Dual request selective task: 0.59
8.	Schoemaker et al (2012)	61 ADHD (80%) 33 DBD (82%) 52 ADHD+DBD (83%) 56 Control (70%)	Referred	Parent and teacher quest. Parent interview Observation	Consensus was reached regarding diagnosis group in study between a child psychiatrist and a clinical child psychologist using multiple data sources.	***Inhibition*** GoNoGo: 0.37 Snack Delay: 0.47 Shape School-inhibit: 0.41 ***Working memory*** Delayed alternation: 0.20 Nine boxes: 0.20

Appendix F
Scale Reliabilities

Reliabilities of Parent and Teacher Scales

Scale	Cronbach's Alpha Parent	Cronbach's Alpha Teacher
CBQ Effortful Control	.79	.88
CBQ Attentional Focusing	.70	.81
CBQ Inhibitory Control	.70	.82
CBQ Low Intensity Pleasure	.62	.73
BRIEF GEC	.95	.98
BRIEF Inhibit	.82	.95
BRIEF Shift	.77	.86
BRIEF Emotional Control	.86	.93
BRIEF Initiate	.71	.88
BRIEF Working Memory	.85	.94
BRIEF Plan/Organize	.83	.86
BRIEF Organization of Materials	.83	.88
BRIEF Monitor	.70	.91
SSIS Social Skills	.93	.96
SSIS Communication	.71	.81
SSIS Cooperation	.83	.91
SSIS Assertion	.65	.79
SSIS Responsibility	.78	.90
SSIS Empathy	.89	.87
SSIS Engagement	.83	.85
SSIS Self Control	.78	.90
SSIS Externalizing behaviors	.74	.86

Reliabilities of TAT

Scale	Cronbach's Alpha Parent	Cronbach's Alpha Teacher
TAT Abstraction	.87	.89
TAT Perceptual Integration	.78	.82
TAT Self-Regulation	.86	.88

Appendix G
Pearson Correlations among Subtests of each Scale

Pearson Correlations among NEPSY-II Subtests (Parent Dataset/Teacher Dataset)

	Auditory Attention	Design Fluency	Inhibition	Statue
Auditory Attention	1	.24*/.24*	.22*/.22*	.12/.14
Design Fluency		1	.17/.17	.29**/.29**
Inhibition			1	.18/.18
Statue				1

Note. *p < .05; **p < .01

Pearson Correlations among TAT Scales (Parent Dataset/Teacher Dataset)

	TAT Abstraction	TAT Perceptual Int.	TAT Self-Regulation
TAT Abstraction	1	. 54**/.59**	.63**/.68**
TAT Perceptual Integration		1	.75**/.77**
TAT Self-Regulation			1

Note. *p < .05; **p < .01

Pearson Correlations among CBQ Parent Effortful Control Subscales

	Attentional Focusing	Inhibitory Control	Low Intensity Pleasure	Perceptual Sensitivity
Attentional Focusing	1	.42**	.29**	.15
Inhibitory Control		1	.38**	.16
Low Intensity Pleasure			1	.25*
Perceptual Sensitivity				1

Note. *p < .05; **p < .01

Pearson Correlations among CBQ Teacher Effortful Control Subscales

	Attentional Focusing	Inhibitory Control	Low Intensity Pleasure	Perceptual Sensitivity
Attentional Focusing	1	.75**	.29**	.32**
Inhibitory Control		1	.27**	.35**
Low Intensity Pleasure			1	.36**
Perceptual Sensitivity				1

Note. *$p < .05$; **$p < .01$

Pearson Correlations among BRIEF Parent Subscales

	Inh.	Shift	Emo. Con.	Init.	Work. Mem.	Plan/ Org.	Org.	Monit.
Inhibit	1	.38**	.48**	.34**	.55**	.43**	.40**	.59**
Shift		1	.57**	.29**	.33**	.28**	.08	.22*
Emo. Control			1	.33**	.26*	.26*	.16	.29**
Initiate				1	.64**	.64**	.46**	.50**
Working Mem.					1	.73**	.50**	.63**
Plan/Organize						1	.59**	.68**
Org. of Mat.							1	.48**
Monitor								1

Note. *$p < .05$; **$p < .01$

Pearson Correlations among BRIEF Teacher Subscales

	Inh.	Shift	Emo. Con.	Init.	Work. Mem.	Plan/ Org.	Org.	Monit.
Inhibit	1	.23*	.65**	.55**	.47**	.43**	.53**	.87**
Shift		1	.56**	.46**	.45**	.61**	.27**	.32**
Emo. Control			1	.53**	.21*	.32**	.40**	.62**
Initiate				1	.63**	.66**	.67**	.73**
Working Mem.					1	.85**	.49**	.58**
Plan/Organize						1	.48**	.61**
Org. of Mat.							1	.69**
Monitor								1

Note. *$p < .05$; **$p < .01$

Pearson Correlations among SSIS Parent Social Skills Subscales

	Comm.	Coop.	Assert.	Resp.	Emp.	Eng.	Self-Control
Communication	1	.56**	.37**	.53**	.41**	.53**	.39**
Cooperation		1	.12	.70**	.44**	.33**	.49**
Assertion			1	.37**	.41**	.62**	.24*
Responsibility				1	.55**	.51**	.57**
Empathy					1	.48**	.55**
Engagement						1	.45**
Self-Control							1

Note. *$p < .05$; **$p < .01$

Pearson Correlations among SSIS Teacher Social Skills Subscales

	Comm.	Coop.	Assert.	Resp.	Emp.	Eng.	Self-Control
Communication	1	.82**	.45**	.84**	.65**	.45**	.54**
Cooperation		1	.29**	.84**	.55**	.20*	.37**
Assertion			1	.42**	.49**	.30**	.18
Responsibility				1	.65**	.24**	.52**
Empathy					1	.33**	.31**
Engagement						1	.72**
Self-Control							1

Note. *$p < .05$; **$p < .01$

Appendix H
Parent-Teacher Agreement

*Pearson correlations between parent and teacher ratings of the same composite scale****

	CBQ Effortful Con. Teacher	BRIEF GEC Teacher	SSIS Social Skills Teacher	SSIS Ext. Problems Teacher
CBQ Effortful Control Parent	.29**			
BRIEF GEC Parent		.33**		
SSIS Social Skills Parent			.25*	
SSIS Externalizing Problems Parent				.36**

Note. $*p < .05$; $**p < .01$

$n = 84$

*** Sample included participants with complete data from parent and teacher informants. Cases were excluded pairwise.

Pearson correlations between the same BRIEF parent and teacher subscales

	Inhibit-T	Shift-T	Emo.-T	Init-T	Wor. Mem.–T	Plan/ Org. -T	Org. Mat.-T	Mon.-T
Inhibit-P	.32**							
Shift-P		-.03						
Emo. Con.-P			.18					
Initiate-P				.19				
Wor. Mem.-P					.41**			
Plan/Organize-P						.27**		

Pearson correlations between the same BRIEF parent and teacher subscales (cont.)

	Inhibit-T	Shift-T	Emo.-T	Init-T	Wor. Mem.–T	Plan/ Org.-T	Org. Mat.-T	Mon.-T
Org. of Materials-P							.31**	
Monitor-P								.31**

Note. **p* < .05; ***p* < .01

n = 84

*** Sample included participants with complete data from parent and teacher informants. Cases were excluded pairwise.

Pearson correlations between the same CBQ Effortful Control parent and teacher subscales

	Attentional Focusing-T	Inhibitory Control-T	Low Intensity Pleasure-T	Perceptual Sensitivity-T
Attentional Focusing-P	.32**			
Inhibitory Control-P		.50**		
Low Intensity Pleasure-P			-.04	
Perceptual Sensitivity-P				.19

Note. **p* < .05; ***p* < .01

n = 84

*** Sample included participants with complete data from parent and teacher informants. Cases were excluded pairwise.

Pearson correlations between the same SSIS Social Skills parent and teacher subscales

	Comm.-T	Coop.-T	Assert.-T	Resp.-T	Emp.-T	Eng.-T	Self-Con.-T
Communication-P	.27*						

Pearson correlations between the same SSIS Social Skills parent and teacher subscales (cont.)

	Comm.-T	Coop.-T	Assert.-T	Resp.-T	Emp.-T	Eng.-T	Self-Con.-T
Cooperation-P		.15					
Assertion-P			.19				
Responsibility-P				.11			
Empathy-P					.31**		
Engagement-P						.11	
Self-Control-P							.05

Note. *$p < .05$; **$p < .01$

$n = 84$

*** Sample included participants with complete data from parent and teacher informants. Cases were excluded pairwise.

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